

STATE OF ALASKA
William A. Egan, Governor



Annual Progress Report for
LIFE HISTORY STUDIES OF RAINBOW TROUT
IN THE KVICHAK DRAINAGE OF BRISTOL BAY

by

D. L. Siedelman, P. B. Cunningham, R. B. Russell

ALASKA DEPARTMENT OF FISH AND GAME

James W. Brooks, Commissioner

DIVISION OF SPORT FISH

Rupert E. Andrews, Director

Howard E. Metsker, Coordinator

TABLE OF CONTENTS

Page No.

| | |
|---------------------|----|
| ABSTRACT | 1 |
| RECOMMENDATIONS | 2 |
| OBJECTIVES | 2 |
| TECHNIQUES USED | 2 |
| FINDINGS | 5 |
| Lower Talarik Creek | 5 |
| Copper River | 29 |
| Nick G. Creek | 47 |
| DISCUSSION | 48 |
| LITERATURE CITED | 50 |

RESEARCH PROJECT SEGMENT

State: Alaska

Project No.: F-9-5

Name: Sport Fish Investigations of
Alaska

Study No.: G-II

Study Title: Sport Fish Studies

Job No.: G-II-E

Job Title: Life History Studies of Rainbow
Trout in the Kvichak Drainage
of Bristol Bay.

Period Covered: July 1, 1972 to June 30, 1973.

ABSTRACT

A temporary weir was constructed for the second consecutive year on the west fork of Lower Talarik Creek to aid in monitoring the spawning migration of rainbow trout, Salmo gairdneri. Data obtained from this weir, and electroshocking, included migrational timing, distribution, age, length, and sex composition of rainbow trout.

Construction of a permanent weir began on June 24 and was completed August 17. The weir was operated intermittently throughout the season due to high water and substrate washing. Rainbow trout samples were collected from portions of the upstream and downstream migrations for determining age, weight, and length relationships. Arctic grayling, Thymallus arcticus, were sampled in connection with the passing of other fish species.

A mortality study was conducted to determine tagging and handling effects on rainbow trout.

Creel census activities were conducted to determine angler utilization of the Lower Talarik Creek rainbow trout population, and to determine age-length relationships of fish in the angler's creel.

A program was initiated at Copper River, another Lake Iliamna tributary, to gather rainbow trout age-weight-length data, migration and spawning data, food habit information, and to provide angler - use and angler - expense information.

Copper River rainbow trout spawning areas were located and cataloged. The peak of spawning occurred during a four-day period, June 3-7. An estimated 750-1,000 rainbow trout spawned during 1972. Collectively, age VIII and IX fish comprised 75.2% of the spawning population.

Seven hundred five Copper River rainbow trout were sampled from May 3-October 9, with a mean length of 709 mm. Of the rainbow trout sampled, 367 were tagged and released. A number of rainbow trout tagged on Copper River were recovered at other Lake Iliamna locations.

Copper River creel census information indicated 269 anglers fished 833 angler days, caught 3,621 rainbow trout, and retained 529. The sport fishermen user-group spent \$128,552.18 to fish this river. The average cost per rainbow trout caught was \$40.04.

RECOMMENDATIONS

1. Continue the life history studies of rainbow trout in the Kvichak River drainage of Bristol Bay through the use of a weir at Lower Talarik Creek.
2. Determine the migration patterns, growth rates, population estimate, age composition, and spawning estimates of rainbow trout in Lower Talarik Creek.
3. Continue collecting and determining creel census information for harvest estimates, recruitment to the angler creel, total man-hours expended, and catch and release ratios at Lower Talarik Creek.
4. Conduct winter surveys to determine if over-wintering by rainbow trout occurs in the headwater lakes of Lower Talarik Creek.

OBJECTIVES

1. To conduct a basic life history study of rainbow trout in Lower Talarik Creek, and adjacent waters in the Kvichak River drainage.
2. To determine the magnitude and impact of recreational fishing on the rainbow trout stocks of Lower Talarik Creek, and adjacent Kvichak River drainage waters.

TECHNIQUES USED

Rainbow trout capturing and sampling was conducted by the use of weir traps, hook and line, gillnets, and back-pack electroshocker. Angler-retained fish were also included in the sample, wherever possible.

All rainbow trout captured were measured for length, using rigid portable measuring boards. Standard fork lengths were recorded to the nearest millimeter (mm).

Lower Talarik Creek rainbow trout over 100 mm were sampled for length, sex, scales, maturity, weight, then tagged and released. Copper River rainbow trout were sampled as above, but only those fish 300 mm or greater in length were tagged. Numbered FD-67 (Floy) internal anchor tags were inserted into the dorsal body musculature so that the anchor section of tags lodged between consecutive pterygiophores. Brown tags were used on Lower Talarik Creek rainbow trout; blue tags on Copper River rainbow trout. Caudal punches were used to mark rainbow trout less than 150 mm in length (at Lower Talarik Creek).

Weights of Lower Talarik Creek rainbow trout were taken with Chatillon 9 kilo (3 kilos X 10 g) autopsy scales. Weights of Copper River rainbow trout were taken with a Chatillon 25 pound (25 X 1 oz.) platform scale, and converted to grams.

Scale samples for age determinations were selected from the left dorsal margin between the lateral line and dorsal fin insertion. Scales were cleaned and mounted on numbered gun cards and impressions made in 0.002-inch thick cellulose acetate cards (2.5 in. X 5 in). Scale impressions were read using a microprojector to determine legibility and age.

All available data related to age samples are presented. Due to illegible, regenerate, and inverted scales, differences appear between the numbers of scale samples collected and scales read.

All rainbow trout scales collected at Lower Talarik Creek during spring (May 16-June 16) and fall (August 30-October 23) were read for age determinations. Scales collected from Lower Talarik Creek rainbow trout during summer (June 17-August 29) were randomly selected for age analysis, by numbering all sampled fish from 1-100 per 100 mm length increments, and selecting all scale samples ending with the random digits six and eight. All legible scales collected during the field season (April 26-October 10) from Copper River rainbow trout were read.

Ages of sampled rainbow trout were determined by counting annular rings from selected scales. Rainbow trout scales used for age determinations were read by a minimum of two readers. Agreement was reached before determined ages were incorporated into the age and growth analysis. Age determinations were not included when disagreements were encountered; however, differences were often resolved by reading one, or several, additional scales from the fish in question.

For the purpose of this study and for ease in field differentiation, subjective criteria used for maturity categories are as follows:

Maturing- Developing kype (male); abdominal contour full and round; silvery coloration; generally 400 mm+ in length (used during the fall to describe fish that would spawn the following spring).

Pre-spawner (male) - Fully developed kype; discharge of milt from anal vent; spawning coloration (dark) with pronounced spotting; abdominal contour full and round.

Pre-spawner (female) - Ovipositor tinted and distended; discharge of loose ripe eggs; spawning coloration (dark) with pronounced spotting.

Post-spawner or "spent" (male) - Abdominal contour concave; discharge of watery milt; anal vent tinted; wounds and lacerations; frayed ventral and caudal fins; dark coloration.

Post-spawners or "spent" (female) - Abdominal contour concave; ovipositor distended and tinted; discharge of water and few or no eggs; frayed caudal and ventral fins; dark coloration.

Non-spawner and Immature - Kype absent (male); induced distention of ovipositor not possible; bright silvery coloration; anal vent not discolored; no scale loss or scale regeneration; no fraying of caudal or ventral fins; generally less than 250 mm in length.

Rainbow trout retained for handling and tagging mortality studies were held in observation pens. Three sides of the pens were of 3/8-inch mesh hardware cloth with the stream bank the remaining side. Burlap bags were suspended in all pens with branches of vegetation attached to provide cover.

A permanent 120-foot structural steel weir with reversible 5/8-inch mesh screens was used to capture immigrant and outmigrant rainbow trout in Lower Talarik Creek. The weir contained two traps: a 7-1/2 ft. x 8 ft. "wulf" type trap for downstream migrants and a 5 ft. x 8 ft. fyke trap for upstream migrants.

A temporary weir was also constructed on the west fork of Lower Talarik Creek to assist in monitoring the spring spawning activities of rainbow trout. The weir was a metal fence post and 5/8-inch hardware cloth construction, with an upstream migrant fyke trap and downstream migrant "wulf" trap.

Spawning ground counts were obtained by foot surveys at Lower Talarik Creek and Copper River. Aerial surveys were also conducted at Lower Talarik Creek.

Creel census information was collected for anglers on both Lower Talarik Creek and Copper River. Economic data was also collected from Copper River anglers. The types of gear used by Copper River sport fishermen were identified and success of anglers using different gear types compared. For purposes of this comparison, flies and lures were defined as follows:

Flies - Terminal tackle constructed by methods known as fly tying, including nymphs, dry, wet, and streamer flies.

Lures - Terminal tackle other than flies (including spoons, spinners, jigs, plugs, and artificial bait).

Expansion of actual creel census data into total "estimated angler-harvest and use" was accomplished by following a ratio-proportion formula:

$$\text{Angler Use: } \frac{\text{anglers checked}}{\text{angler hrs. checked}} = \frac{\text{anglers observed}}{\text{unknown (total angler hrs.)}}$$

$$\text{Angler Harvest: } \frac{\text{anglers checked}}{\text{Rainbow checked}} = \frac{\text{anglers observed}}{\text{unknown (total RB harvest)}}$$

FINDINGS

Lower Talarik Creek

Spring Spawning Activities:

Rainbow Trout:

A temporary weir was erected for the second consecutive year, on the west fork of Lower Talarik Creek, to assist in determining the numbers and migrational characteristics of spawning rainbow trout, Salmo gairdneri (Figure 1). Weir construction began May 24 and was completed May 29. The weir was intermittently operated due to high water and ice conditions until June 9, after which the weir was continuously operated through June 16.

Electrofishing was conducted in conjunction with the temporary weir operation. Rainbow trout were electroshock-sampled on the spawning grounds to determine maturity, incidence of consecutive spawning, and to recover previously tagged fish.

Water temperatures appear to affect the migrational timing and spawning activities. Rainbow trout were first observed entering Lower Talarik Creek on May 22, when water temperatures reached 1.7°C (Table 1). Rainbow trout were observed paired on the spawning grounds and actively spawning June 4, when water temperatures reached 2.8°C.

Peak rainbow trout spawning activity was observed on the west fork of Lower Talarik Creek June 6, when an aerial and foot survey provided an estimate of 270-300 active spawners. The major rainbow trout spawning activity in the west-east-fork is concentrated throughout the lower 1.4 miles of stream area, above the west-east-fork confluence. This area represents 54.4% of the 2.6-mile length of the Lower Talarik Creek west fork.

The first upstream migrant rainbow trout was captured at the temporary west fork weir of Lower Talarik Creek on May 29. Forty-eight upstream and 34 downstream migrant rainbow trout were sampled for a total of 82 rainbow trout enumerated and sampled before dismantling the weir on June 17.

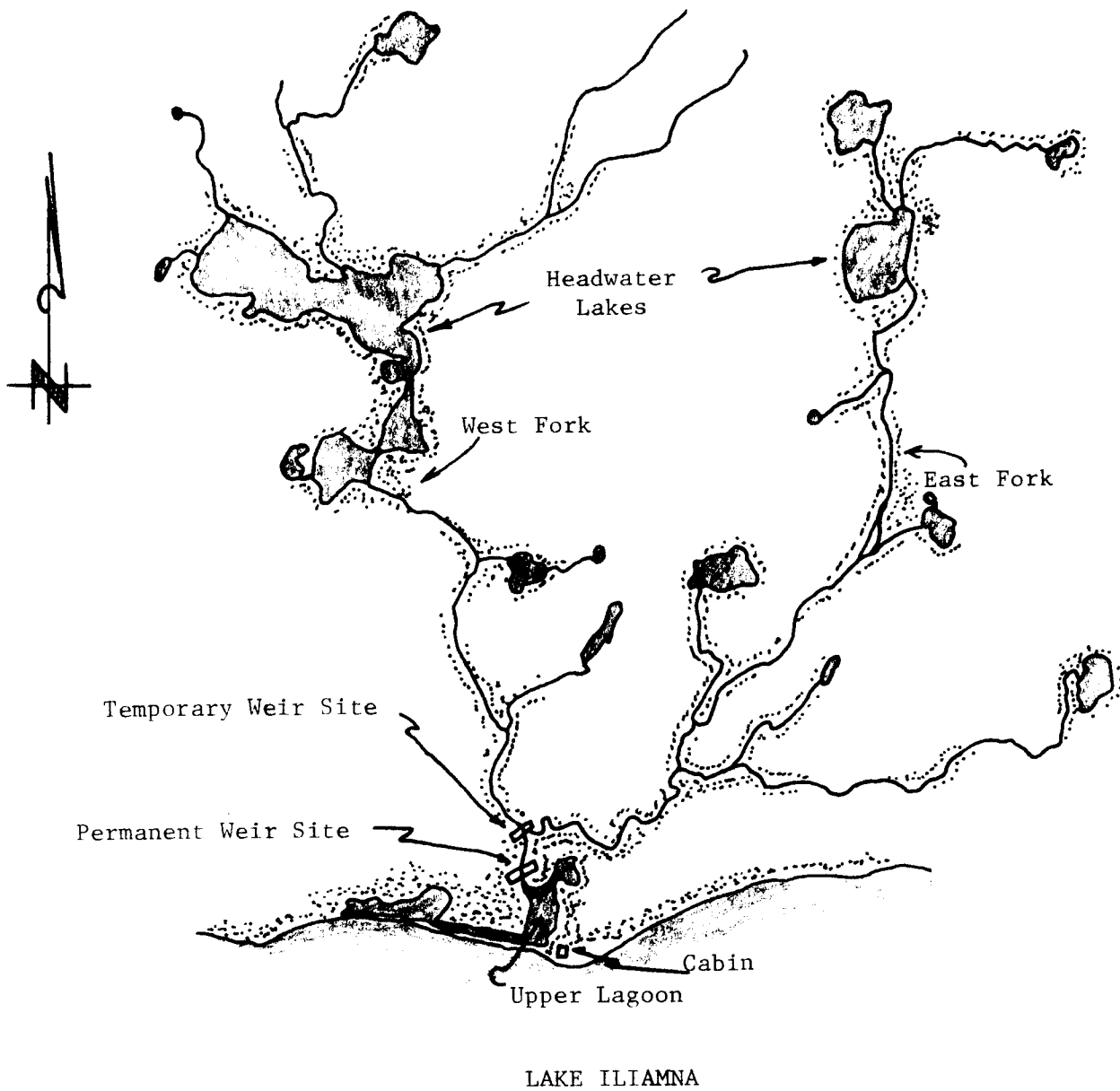


FIGURE 1 Rainbow Trout Research Site, Lower Talarik Creek, 1972.

TABLE 1 Climatological Profile, West Fork Lower Talarik Creek, May 17 - June 17, 1972.

| Date | Weather Parameters | | | |
|-----------------|--------------------|---------------|-------------------|-----------------|
| | Precipitation | Cloud Cover | Water Temp. (°C)* | Air Temp. (°C)* |
| 5-17 | Snow | Full overcast | 0.0 | 0.6 |
| 5-18 | Snow | Full overcast | 0.0 | 1.1 |
| 5-19 | Snow | Full overcast | 0.0 | 0.0 |
| 5-20 | Snow | Full overcast | 0.0 | 1.7 |
| 5-21 | - | Clear sky | 1.1 | 17.2 |
| 5-22 | - | Clear sky | 1.7 | 16.1 |
| 5-23 | Trace | Full overcast | 0.0 | 2.8 |
| 5-24 | - | 50% plus | 0.0 | 1.7 |
| 5-25 | - | 50% plus | 0.0 | 1.1 |
| 5-26 | - | Clear | 2.8 | 14.9 |
| 5-27 | - | 50% plus | 2.8 | 11.7 |
| 5-28 | - | 50% plus | 1.1 | 10.0 |
| 5-29 | - | Clear sky | 1.1 | 7.8 |
| 5-30 | - | Clear sky | 6.1 | 11.1 |
| 5-31 | - | Clear sky | 3.9 | 7.8 |
| Avg., May 17-31 | | | <u>1.4</u> | <u>6.9</u> |
| 6-1 | - | Full overcast | 1.7 | 11.1 |
| 6-2 | Snow & rain | Full overcast | 1.7 | 11.1 |
| 6-3 | - | Full overcast | 5.0 | 11.1 |
| 6-4 | - | 50% plus | 6.7 | 6.7 |
| 6-5 | - | Less than 50% | 5.6 | 8.4 |
| 6-6 | - | 50% plus | 6.7 | 7.8 |
| 6-7 | - | 50% plus | 6.1 | 1.7 |
| 6-8 | - | Clear sky | 5.0 | 1.7 |
| 6-9 | - | Full overcast | 5.6 | 5.6 |
| 6-10 | - | Full overcast | 5.6 | 5.6 |
| 6-11 | - | Full overcast | 6.1 | 8.4 |
| 6-12 | Intermittent rain | 50% plus | 6.7 | 6.7 |
| 6-13 | Intermittent rain | 50% plus | 6.1 | 7.8 |
| 6-14 | - | Less than 50% | 8.4 | 7.2 |
| 6-15 | - | 50% plus | 6.1 | 4.5 |
| 6-16 | - | Full overcast | 6.1 | 5.6 |
| 6-17 | - | Full overcast | 6.1 | 5.6 |
| Avg., June 1-17 | | | <u>5.6</u> | <u>6.9</u> |

Daily Maximum Temperature readings. *

TABLE 2 Spawning Rainbow Trout Length Frequency by Sex and Maturity,
West Fork Lower Talarik Creek, May 26 - June 16, 1972.

| Length (mm) | Sex by Spawners | | Immature or Non-Spawners | Total |
|-------------------|-----------------|----------|-----------------------------|----------|
| | Males | Females | | |
| 125-149 | - | - | 8 | 8 |
| 150-174 | - | - | 2 | 2 |
| 175-199 | - | - | 2 | 2 |
| 200-224 | - | - | 6 | 6 |
| 225-249 | - | - | 10 | 10 |
| 250-274 | - | - | 6 | 6 |
| 275-299 | 1 | - | 5 | 6 |
| 300-324 | 2 | - | 11 | 13 |
| 324-349 | 4 | 1 | 12 | 17 |
| 350-374 | 6 | - | 9 | 15 |
| 375-399 | 3 | - | 7 | 10 |
| 400-424 | 3 | 5 | 4 | 12 |
| 425-449 | 2 | 5 | - | 7 |
| 450-474 | 2 | 2 | 2 | 6 |
| 475-499 | 2 | 4 | - | 6 |
| 500-524 | 4 | 7 | - | 11 |
| 525-549 | 1 | 7 | 1 | 9 |
| 550-574 | 5 | 7 | - | 12 |
| 575-599 | 6 | 6 | - | 12 |
| 600-624 | 6 | 11 | - | 17 |
| 625-649 | 4 | 4 | - | 8 |
| 650-674 | 7 | 4 | - | 11 |
| 675-699 | 3 | 4 | - | 7 |
| 700-724 | 2 | 1 | - | 3 |
| 725-749 | 2 | - | - | 2 |
| 750-774 | - | - | - | - |
| 775-799 | - | - | - | - |
| 800-824 | <u>1</u> | <u>-</u> | <u>-</u> | <u>-</u> |
| Total | 66 | 68 | 85 | 219 |
| Length Range (mm) | 277-803 | 327-718 | | 132-803 |
| Mean Length (mm) | 530 | 554 | | 446 |

Electroshock sampling was conducted on the spawning ground from June 3 through June 16, with a total of 137 rainbow trout sampled. Of the 219 rainbow trout sampled, 11 were previously tagged. Two of the 11 tag recoveries were female trout noted as spawners during the spring of 1971. Consecutive spawning for female rainbow trout is indicated to some extent, since both females were noted as post spawners.

Length-frequency of rainbow trout by maturity is presented in Table 2. Of the 219 rainbow trout sampled, 61.2% were noted as spawners and the remainder immature or non-spawners. A high percentage of the sample were post-spawners (primarily collected by electrofishing on the spawning grounds above the weir).

The mean length of female rainbow trout sampled during spawning was greater than that of males. Table 3 indicates that some of the male rainbow trout mature at an earlier age than females. These smaller mature males could be termed precocial.

Spawning female rainbow trout are predominant in the spawning population. The male-to-female ratio of 134 sexually dimorphic rainbow trout was 66:68 (0.97:1) (Table 3). The data obtained in 1971 indicated a male to female ratio of 51:79 (0.6:1) (Siedelman and Cunningham, 1972). Thus, an increase of males (5.6%) was observed on the spawning grounds in 1972.

In 1972, 134 rainbow trout spawners were sampled for scales, 86 of which were legible for age analysis. The youngest spawning rainbow trout recorded was age V for males and age VI for females (Table 3).

TABLE 3 Spawning Rainbow Trout Age-Frequency by Sex, West Fork Lower Talarik Creek, May 26-June 16, 1972.

| Age Class | Male | | Female | | Total | |
|--------------|------|--------|--------|---------|-------|---------|
| | No. | (%) | No. | (%) | No. | (%) |
| V | 2 | (5.4) | - | - | 2 | (2.3) |
| VI | 6 | (16.2) | 2 | (4.1) | 8 | (9.3) |
| VII | 12 | (32.4) | 21 | (42.9) | 33 | (38.9) |
| VIII | 12 | (32.4) | 18 | (36.7) | 30 | (34.9) |
| IX | 3 | (8.1) | 5 | (10.2) | 8 | (9.3) |
| X | 1 | (2.7) | 3 | (6.1) | 4 | (4.7) |
| XI | 1 | (2.7) | - | - | 1 | (1.2) |
| Total | 37 | (99.9) | 49 | (100.0) | 86 | (100.0) |

Thus, information gathered from two consecutive spring spawning seasons, indicates male and female rainbow trout reach spawning maturity at age IV and VI, respectively (Siedelman and Cunningham, 1972).

Male rainbow trout, once sexually mature, are members of the potential spawning population from age IV to XI. Female rainbow trout, once sexually mature, are contributors to the potential spawning population from age VI to X. Of the 37 males and 49 females sampled, 32 (86.5%) and 41 (83.7%) respectively, were age VII or less. No immature rainbow trout were found older than age VII. After age XI for male and X for female rainbow trout, there appear to be very few survivors. No spawning rainbow trout have been noted older than age XI.

Length-age frequency of rainbow trout sampled during the temporary weir operation is presented in Table 4.

Permanent Weir Operations:

Rainbow Trout:

Construction of a permanent weir was initiated on June 24, 1972. Substrate type, access, and seasonal water levels were considered in choosing the site (Figure 2). Construction of foundation and uprights was completed on July 17 and the upstream migrant trap attached to the weir foundation on July 21. An operation and maintenance schedule (0900-2200 hours) was initiated. The wulf trap was inserted into the weir on August 17. The weir operated continuously from August 17 until August 19, when high water caused the substrate to wash out, rendering the weir ineffective. The weir was repaired and operational on August 29. During September and early October, weir operations were intermittent due to a weir design allowing substrate washing.

Icing conditions occurred October 7 and terminated weir operations for the season. Hook and line sampling for tag recoveries was continued until October 23, and on October 24, 1972, the program was terminated.

Upstream migration of rainbow trout was sporadic throughout the weir operation periods (Table 5). Due to the intermittent weir operations, the number of upstream migrant rainbow trout sampled through the weir was incomplete. The upstream trap did, however, catch fish even though the weir screens were removed.

Downstream migration rainbow trout monitoring commenced on August 17, when the wulf trap was attached to the weir. The weir remained operational until August 19 when a washout occurred. The weir was again fully operational on August 29. The first downstream migrant rainbow trout was captured on August 23 (Table 6). Complete monitoring of the downstream population was not possible due to intermittent periods of high water, causing the screens to be pulled.

A milling tendency of many juvenile rainbow trout was observed. Juvenile rainbow trout, tagged as upstream migrants would be recaptured on subsequent days as downstream migrants and again as upstream migrants.

TABLE 4. Rainbow Trout Length-Age Frequency, West Fork Lower Talarik Creek,
May 26 - June 16, 1972.

| Length (mm) | Age Class | | | | | | | | | Tot. |
|------------------|-----------|---------|---------|---------|---------|---------|---------|---------|-----|---------|
| | III | IV | V | VI | VII | VIII | IX | X | XI | |
| 125-149 | 1 | - | - | - | - | - | - | - | - | 1 |
| 150-174 | - | - | - | - | - | - | - | - | - | - |
| 175-199 | - | 1 | - | - | - | - | - | - | - | 1 |
| 200-224 | - | 2 | 1 | - | - | - | - | - | - | 3 |
| 225-249 | - | 3 | - | - | - | - | - | - | - | 3 |
| 250-274 | - | - | 4 | - | - | - | - | - | - | 4 |
| 275-299 | - | - | 3 | - | - | - | - | - | - | 3 |
| 300-324 | - | - | 6 | 4 | - | - | - | - | - | 10 |
| 325-349 | - | - | 2 | 10 | - | - | - | - | - | 12 |
| 350-374 | - | - | - | 10 | 1 | - | - | - | - | 11 |
| 375-399 | - | - | - | 3 | 2 | - | - | - | - | 5 |
| 400-425 | - | - | - | 3 | 6 | - | - | - | - | 9 |
| 425-449 | - | - | - | - | 1 | - | - | - | - | 1 |
| 450-474 | - | - | - | 1 | 4 | 1 | - | - | - | 6 |
| 475-499 | - | - | - | - | 3 | - | - | - | - | 3 |
| 500-524 | - | - | - | - | 1 | 5 | - | - | - | 6 |
| 525-549 | - | - | - | - | 3 | 2 | - | - | - | 5 |
| 550-574 | - | - | - | - | 6 | 2 | - | - | - | 8 |
| 575-599 | - | - | - | - | 7 | 3 | - | - | - | 10 |
| 600-624 | - | - | - | - | 3 | 8 | 2 | - | - | 13 |
| 625-649 | - | - | - | - | 1 | 4 | 2 | - | - | 7 |
| 650-674 | - | - | - | - | - | 2 | 1 | 2 | - | 5 |
| 675-699 | - | - | - | - | - | 2 | 2 | 2 | - | 6 |
| 700-724 | - | - | - | - | - | 2 | 1 | - | - | 3 |
| 725-749 | - | - | - | - | - | - | - | - | - | - |
| 750-774 | - | - | - | - | - | - | - | - | - | - |
| 775-799 | - | - | - | - | - | - | - | - | - | - |
| 800-824 | - | - | - | - | - | - | - | - | 1 | 1 |
| Total | 1 | 6 | 16 | 31 | 38 | 31 | 8 | 4 | 1 | 136 |
| Length | | | | | | | | | | |
| Range (mm) | 147 | 197-248 | 217-345 | 313-457 | 367-631 | 462-718 | 608-705 | 654-698 | 803 | 147-803 |
| Mean Length (mm) | 147 | 224 | 293 | 359 | 512 | 596 | 653 | 674 | 803 | 471 |
| Mean Growth | | | | | | | | | | |
| Increment (mm) | 77 | 69 | 66 | 153 | 84 | 62 | 16 | 129 | | |

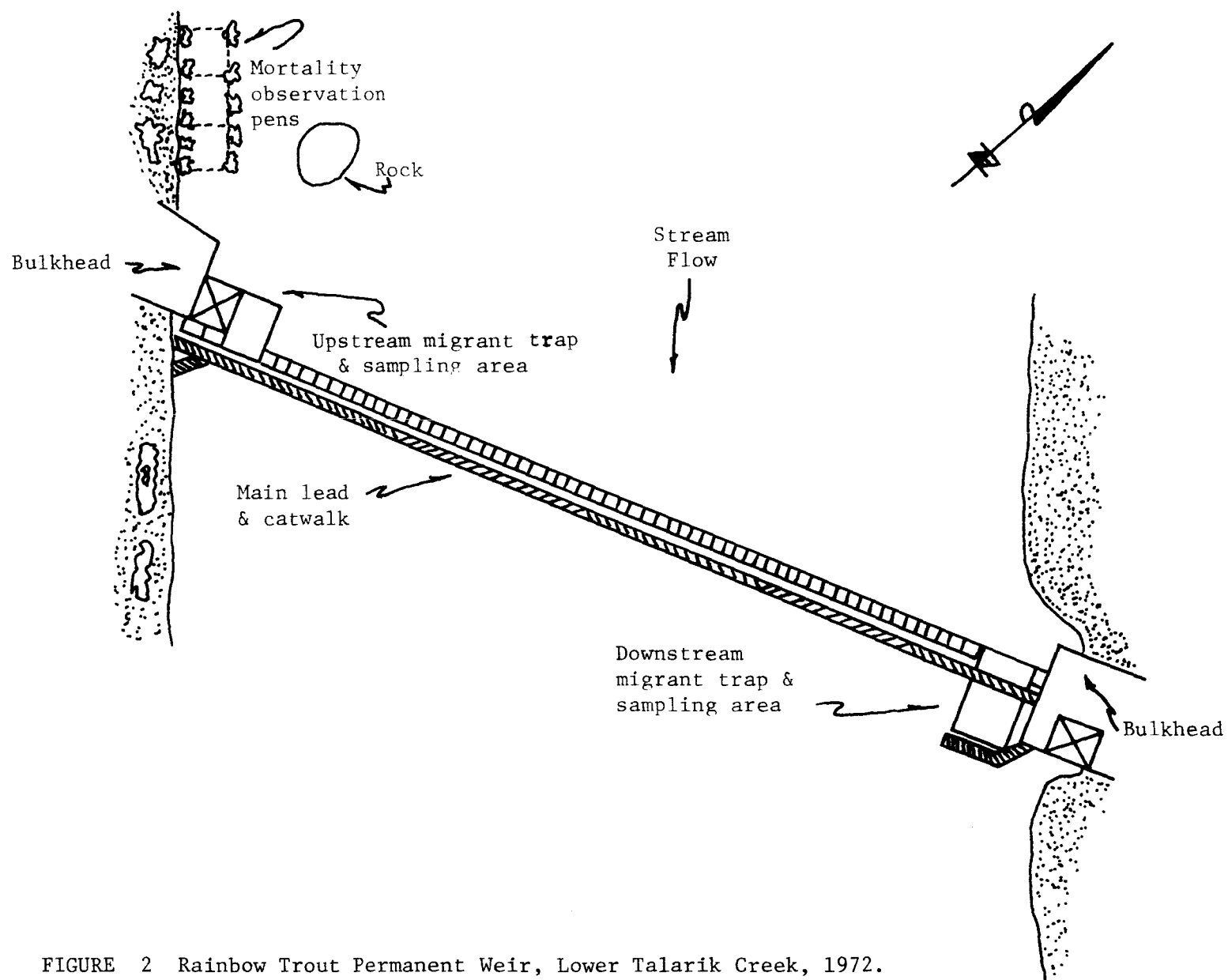


FIGURE 2 Rainbow Trout Permanent Weir, Lower Talarik Creek, 1972.

TABLE 5. Upstream Migrant Rainbow Trout, Number and Timing, Lower Talarik Creek, Permanent Weir, July 21-October 5, 1972.

| <u>Date</u> | <u>Upstream Migrant</u> | <u>Date</u> | <u>Upstream Migrant</u> | <u>Date</u> | <u>Upstream Migrant</u> |
|-------------|-----------------------------|-------------|-----------------------------|-------------|-----------------------------|
| 7/21 | 8 * | 8/20 | - *** | 9/19 | 15 ** |
| 7/22 | 12 * | 8/21 | - *** | 9/20 | 34 ** |
| 7/23 | 2 * | 8/22 | 8 *** | 9/21 | 17 ** |
| 7/24 | 11 * | 8/23 | 13 *** | 9/22 | 4 ** |
| 7/25 | 13 * | 8/24 | 12 *** | 9/23 | 7 ** |
| 7/26 | 2 * | 8/25 | - *** | 9/24 | 14 ** |
| 7/27 | 8 * | 8/26 | - *** | 9/25 | 12 ** |
| 7/28 | 20 * | 8/27 | - *** | 9/26 | 19 ** |
| 7/29 | 6 * | 8/28 | - *** | 9/27 | 62 ** |
| 7/30 | 8 * | 8/29 | - *** | 9/28 | 35 *** |
| 7/31 | 52 * | 8/30 | 77 ** | 9/29 | - *** |
| 8/1 | 49 * | 8/31 | 54 ** | 9/30 | - *** |
| 8/2 | 11 * | 9/1 | 0 ** | 10/1 | - *** |
| 8/3 | 26 * | 9/2 | 39 ** | 10/2 | - *** |
| 8/4 | 40 * | 9/3 | 30 *** | 10/3 | - *** |
| 8/5 | 40 * | 9/4 | - *** | 10/4 | - *** |
| 8/6 | 35 * | 9/5 | 20 *** | 10/5 | 6 *** |
| 8/7 | 60 * | 9/6 | 10 *** | 10/6 | - *** |
| 8/8 | 38 * | 9/7 | 7 ** | 10/7 | - *** |
| 8/9 | 55 * | 9/8 | 10 ** | | |
| 8/10 | 13 * | 9/9 | 12 ** | Total | 1,434 |
| 8/11 | 42 ** | 9/10 | 11 ** | | |
| 8/12 | 36 ** | 9/11 | 22 ** | | |
| 8/13 | 2 ** | 9/12 | 16 ** | | |
| 8/14 | 20 ** | 9/13 | 19 ** | | |
| 8/15 | 38 ** | 9/14 | 19 *** | | |
| 8/16 | 12 ** | 9/15 | - *** | | |
| 8/17 | 0 ** | 9/16 | 13 *** | | |
| 8/18 | 136 ** | 9/17 | 9 *** | | |
| 8/19 | - *** | 9/18 | 13 ** | | |

* 0900-2200 Schedule

** 24-hour Schedule

*** Weir partial barrier or inoperable

TABLE 6 Downstream Migrant Rainbow Trout, Number and Timing,
Lower Talarik Creek, Permanent Weir, August 17 -
October 5, 1972.

| <u>Date</u> | <u>Downstream Migrant</u> | <u>Date</u> | <u>Downstream Migrant</u> | <u>Date</u> | <u>Downstream Migrant</u> |
|-------------|-------------------------------|-------------|-------------------------------|-------------|-------------------------------|
| 8/17 | - ** | 9/6 | 0 * | 9/26 | 0 * |
| 8/18 | 0 * | 9/7 | 0 * | 9/27 | 0 * |
| 8/19 | - ** | 9/8 | 7 * | 9/28 | - ** |
| 8/20 | - ** | 9/9 | 0 * | 9/29 | - ** |
| 8/21 | - ** | 9/10 | 0 * | 9/30 | - ** |
| 8/22 | - ** | 9/11 | 0 * | 10/1 | - ** |
| 8/23 | 1 ** | 9/12 | 1 * | 10/2 | - ** |
| 8/24 | - ** | 9/13 | 0 * | 10/3 | - ** |
| 8/25 | - ** | 9/14 | - ** | 10/4 | - ** |
| 8/26 | - ** | 9/15 | - ** | 10/5 | - ** |
| 8/27 | - ** | 9/16 | - ** | 10/6 | - ** |
| 8/28 | - ** | 9/17 | 4 ** | 10/7 | ----- |
| 8/29 | - ** | 9/18 | 62 * | | |
| 8/30 | 1 * | 9/19 | 1 * | Total | 167 |
| 8/31 | 0 * | 9/20 | 3 * | | |
| 9/1 | 0 * | 9/21 | 0 * | | |
| 9/2 | 49 * | 9/22 | 0 * | | |
| 9/3 | 37 ** | 9/23 | 1 * | | |
| 9/4 | - ** | 9/24 | 0 * | | |
| 9/25 | - ** | 9/25 | 0 * | | |

* 24-hour schedule

** Weir partial barrier or inoperable

Young-of-the-year rainbow trout were first observed moving downstream on July 5, and continued through July 17. The rainbow trout fry moved downstream and schooled in the Upper Lagoon.

Tag recoveries of rainbow trout previously tagged at Lower Talarik Creek during the period July 1 to October 23, numbered 32. Four of the tag recoveries (12.5%) were captured at locations other than Lower Talarik Creek. Two were from Igiugig, one from Pecks Creek, and one from Kokhanok. These recoveries further document the dispersion of Lower Talarik Creek rainbow trout in the Kvichak River watershed (Figure 3).

Further studies to determine migratory trends are needed. Such studies may define the maximum exploitative pressure the Lake Ilimna rainbow trout population can adequately sustain. A rainbow trout population from a given stream may receive multiple exploitative pressures while migrating to or from another stream(s).

Two rainbow trout tag recoveries, originally captured and tagged as upstream migrants at the permanent weir, were recaptured by hook and line at "the Narrows" between the first and second headwater lakes of the Lower Talarik Creek west fork (Figure 1). Both rainbow trout were noted as maturing when tagged, on September 14 and 27, and when recaptured, on October 18 and 23. The rainbow trout captured were not spawning, thus perhaps indicating that some portion of the fall upstream migration of pre-spawning rainbow trout over-winters in the headwater lakes of the Lower Talarik Creek, west fork, and migrate downstream the following spring to spawn.

To date, no fall spawning rainbow trout have been observed in Lower Talarik Creek. During the weir operation period, on upstream or downstream migration rainbow trout were observed in spawning or post-spawning conditions. Water temperatures after October are probably not conducive to rainbow trout spawning activities. These observations reinforce the assumption that Lower Talarik Creek rainbow trout spawning is restricted to spring months.

Age-weight-length relationships:

A total of 1,601 rainbow trout were enumerated through the weir from July 21-October 5. Of this number, 1,434 (89.6%) were upstream migrants and 167 (10.4%) downstream migrants. Immigrant rainbow trout lengths ranged from 117 to 775 mm (Table 7). A total of 196 (13.75%) upstream migrants were noted as maturing, and 1,234 (86.3%) as immature or non-spawners (maturity was not determined for four of the 1,434 upstream migrant rainbow trout). It is suspected that the 201 rainbow trout, noted as maturing, will be recruited to the active rainbow trout spawning population the following spring.

It was noted that of the 167 downstream migrating rainbow trout, all were immature, except three fish which were designated maturing. One of the three fish was tagged as upstream migrant on August 30 and recovered again on August 30 as a downstream migrant (Table 8).

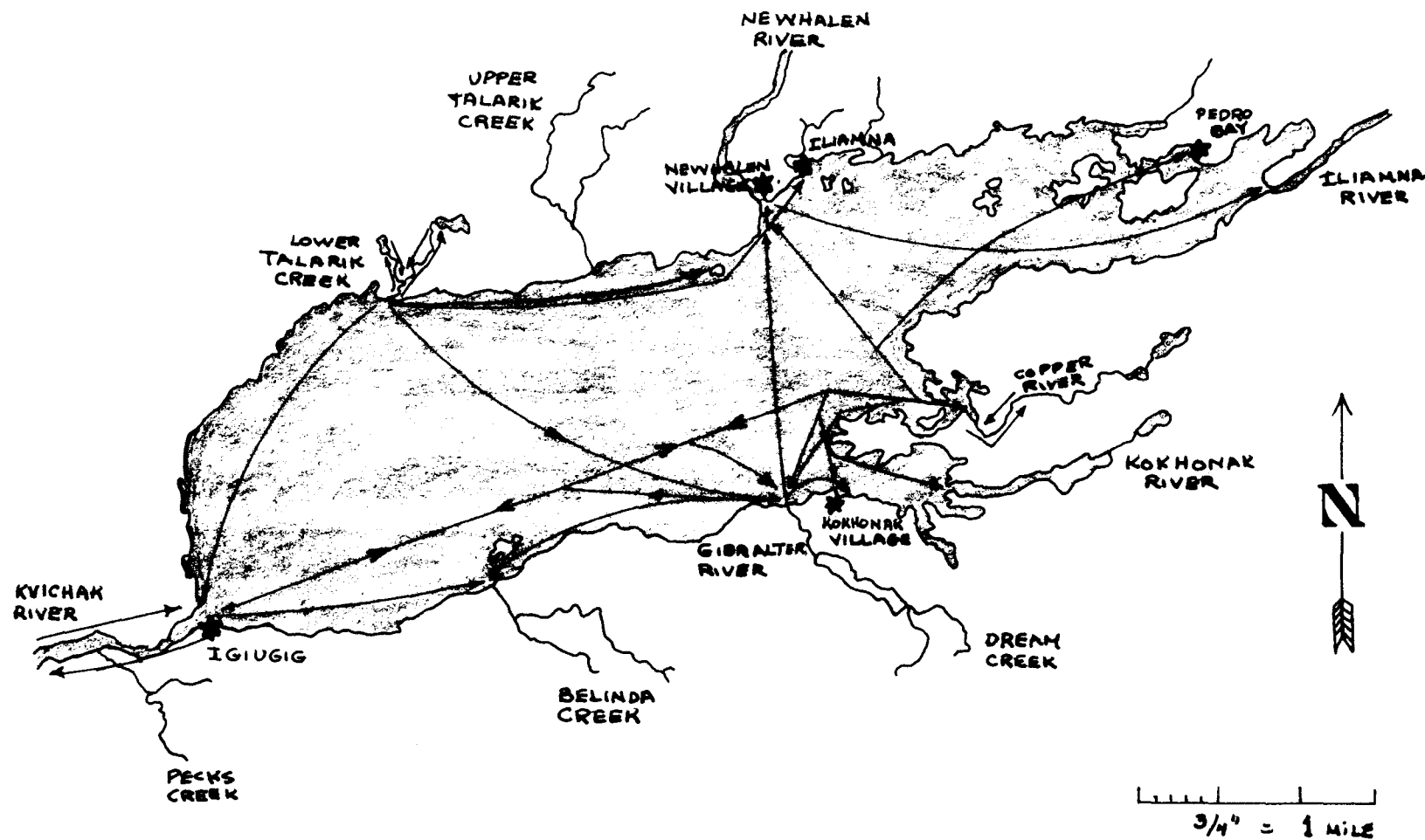


FIGURE 3 Rainbow Trout Migratory Patterns In Lake Iliamna From Tag Recovery Information.

TABLE 7 Length Frequency of Upstream Migrant Rainbow Trout by Maturity
Lower Talarik Creek Permanent Weir, July 21 - October 5, 1972.

| <u>Length (mm)</u> | <u>Maturity</u> | | <u>Total</u> |
|--------------------|-----------------|----------------------------------|--------------|
| | <u>Maturing</u> | <u>Immature & Nonspawner</u> | |
| 100-124 | - | 3 | 3 |
| 125-149 | - | 14 | 14 |
| 150-174 | - | 47 | 47 |
| 175-199 | - | 127 | 127 |
| 200-224 | - | 180 | 180 |
| 225-249 | - | 202 | 202 |
| 250-274 | - | 196 | 196 |
| 275-299 | - | 146 | 146 |
| 300-325 | 2 | 56 | 58 |
| 325-349 | 1 | 61 | 62 |
| 350-374 | 4 | 64 | 68 |
| 375-399 | 2 | 58 | 60 |
| 400-424 | 4 | 41 | 45 |
| 425-449 | 9 | 12 | 21 |
| 450-474 | 10 | 13 | 23 |
| 475-499 | 8 | 5 | 14 |
| 500-524 | 25 | 4 | 29 |
| 525-549 | 24 | 3 | 27 |
| 550-574 | 27 | 2 | 29 |
| 575-599 | 27 | - | 27 |
| 600-624 | 18 | - | 18 |
| 625-649 | 14 | - | 14 |
| 650-674 | 10 | - | 10 |
| 675-699 | 7 | - | 7 |
| 700-724 | 2 | - | 2 |
| 725-749 | - | - | - |
| 750-774 | - | - | - |
| 775-799 | 1 | - | 1 |
| Total | 196 | 1,232 | 1,433 |
| Length Range (mm) | 320-775 | 117-563 | 117-775 |
| Mean Length (mm) | 551 | 267 | 309 |

TABLE 8. Length Frequency of Downstream Migrant Rainbow Trout by Maturity, Lower Talarik Creek Permanent Weir, July 21-October 5, 1972.

| <u>Length (mm)</u> | <u>Maturity</u> | | <u>Total</u> |
|--------------------|-----------------|----------------------------------|--------------|
| | <u>Maturing</u> | <u>Immature & Nonspawner</u> | |
| 125-149 | - | 3 | 3 |
| 150-174 | - | 8 | 8 |
| 175-199 | - | 32 | 32 |
| 200-224 | - | 34 | 34 |
| 225-249 | - | 27 | 27 |
| 250-274 | - | 20 | 20 |
| 275-299 | - | 21 | 21 |
| 300-324 | - | 7 | 7 |
| 325-349 | - | 5 | 5 |
| 350-374 | - | 3 | 3 |
| 375-399 | - | 2 | 2 |
| 400-424 | - | 2 | 2 |
| 425-449 | - | - | - |
| 450-474 | - | - | - |
| 475-499 | - | - | - |
| 500-524 | 1 | - | 1 |
| 525-549 | - | - | - |
| 550-574 | 1 | - | 1 |
| 575-599 | - | - | - |
| 600-624 | - | - | - |
| 625-649 | - | - | - |
| 650-674 | - | - | - |
| 675-699 | <u>1</u> | <u>-</u> | <u>1</u> |
| Total | 3 | 164 | 167 |
| Length Range (mm) | 560-680 | 125-250 | 125-680 |
| Mean Length (mm) | 587 | 238 | 245 |

On August 14, an autopsy scale was installed at the permanent weir site. Subsequently, 906 rainbow trout were sampled for weight in addition to length, scales, sex, and maturity. Linear regression analysis of 905 lengths and weights yielded the following length-weight relationship:

$$\text{Length} = 239.14 + (1.48 \times \text{weight})$$

The correlation coefficient is 0.9317 with a R^2 value indicated that percentage (86.8%) of the data accounted for in the regression formula. Weight frequency of rainbow trout, by maturity, is presented in Table 9.

Of 905 rainbow trout weighed, 798 (88.2%) were upstream migrants, and 107 (11.8%) were downstream migrants. Upstream migrant rainbow trout weights ranged from 0.01 kg to 5.54 kg with downstream migrant rainbow trout ranging from 0.01 kg to 1.32 kg.

Nine hundred fourteen rainbow trout scales were collected, yielding 822 legible scales for age determinations. Age classes IV and V constituted 58.9% of age classes represented (Table 10). Age VI to VII rainbow trout exhibited the largest growth increment. In 1971, ages VII to VIII had the largest growth increment (Siedelman and Cunningham, 1972). This dynamic growth may indicate age at which rainbow trout are recruited to the migratory population in Lake Iliamna. Lake Iliamna may provide an environment equivalent to an inland freshwater sea and provide nutrients conducive to rapid growth not found in parental streams.

Handling and tagging mortality studies were conducted with three control groups: Group 1 - 32 rainbow trout were tagged, sampled for length, weight, scales, sex, maturity, and placed in observation pens. Group 2 - 30 rainbow trout were sampled as group #1 with the exclusion of tagging. Group 3 - 27 rainbow trout were taken from the fish traps and transported directly to holding and observation pens without sampling (Figure 2).

All rainbow trout were held and observed for a minimum of 14 days. Mortality, abnormal behavior, or physical impairment were noted.

The study was initiated July 30 and terminated August 18 with no observed mortalities as a result of handling or tagging. In group 3, a fish injured prior to capture died. No short-term tag loss was noted.

Effectiveness of Lower Talarik Creek Weir:

Lower Talarik Creek weir effectively blocked and trapped rainbow trout 117 mm in length and larger. The upstream migrant fyke trap effectively trapped all upstream migrating species. The trap would fill on occasion with red salmon, Oncorhynchus nerka, regardless of efforts to clear the trap. Intermingled rainbow trout suffered severe abrasion and scale loss. Rainbow trout trap mortality was high during periods of peak red salmon upstream migration. Injured or dying rainbow trout were held in observation pens, tagged, and released when recovery was assured. Scale loss, in excess of 10%, was considered critical, although all rainbow trout with observable scale loss were retained for observation during this period.

TABLE 9 Upstream and Downstream Migrant Rainbow Trout Weight Frequency, by Stage of Maturity, Lower Talarik Creek Permanent Weir, August 14 - October 5, 1972.

| <u>Weight (kg)</u> | <u>Upstream Migrants</u> | | <u>Downstream Migrants</u> | | <u>Total</u> |
|--------------------|--------------------------|-----------------------------------|----------------------------|-----------------------------------|--------------|
| | <u>Maturing</u> | <u>Immature & Nonspawners</u> | <u>Maturing</u> | <u>Immature & Nonspawners</u> | |
| 0.01-0.49 | 6 | 543 | - | 103 | 652 |
| 0.50-0.99 | 17 | 61 | | 1 | 79 |
| 1.00-1.49 | 23 | 2 | 2 | - | 27 |
| 1.50-1.99 | 44 | 1 | - | - | 45 |
| 2.00-2.49 | 48 | - | - | - | 48 |
| 2.50-2.99 | 29 | - | 1 | - | 30 |
| 3.00-3.49 | 14 | - | | - | 14 |
| 3.50-3.99 | 6 | - | | - | 6 |
| 4.00-4.49 | 2 | - | | - | 2 |
| 4.50 + | <u>2</u> | <u>-</u> | <u>-</u> | <u>-</u> | <u>2</u> |
| Total | 191 | 607 | 3 | 104 | 905 |
| Weight range (kg) | 0.01-5.54 | 0.01-1.98 | 1.25-2.92 | 0.01-0.51 | 0.01-5.54 |
| Mean weight (kg) | 2.04 | 0.19 | 1.83 | 0.18 | 0.59 |

TABLE 10. Length Frequency, Rainbow Trout by Age, Lower Talarik Creek Permanent Weir and Hook and Line, July 21 - October 23, 1972.

| Length (mm) | Age Class | | | | | | | | | Tot. |
|------------------|-----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | II | III | IV | V | VI | VII | VIII | IX | X | |
| 100-124 | 1 | - | - | - | - | - | - | - | - | 1 |
| 125-149 | 3 | 3 | - | - | - | - | - | - | - | 6 |
| 150-174 | 1 | 26 | 2 | - | - | - | - | - | - | 29 |
| 175-199 | - | 48 | 46 | - | - | - | - | - | - | 94 |
| 200-224 | - | 2 | 127 | 4 | - | - | - | - | - | 133 |
| 225-249 | - | - | 86 | 51 | - | - | - | - | - | 137 |
| 250-274 | - | - | 7 | 81 | 3 | - | - | - | - | 91 |
| 275-299 | - | - | - | 58 | 7 | - | - | - | - | 65 |
| 300-324 | - | - | - | 18 | 12 | - | - | - | - | 30 |
| 325-349 | - | - | - | 4 | 13 | 2 | - | - | - | 19 |
| 350-374 | - | - | - | - | 13 | 3 | - | - | - | 16 |
| 375-399 | - | - | - | - | 14 | 4 | - | - | - | 18 |
| 400-425 | - | - | - | - | 8 | 9 | - | - | - | 17 |
| 425-449 | - | - | - | - | 1 | 7 | - | - | - | 8 |
| 450-474 | - | - | - | - | - | 11 | - | - | - | 11 |
| 475-499 | - | - | - | - | - | 5 | 4 | - | - | 9 |
| 500-524 | - | - | - | - | 1 | 13 | 9 | - | - | 23 |
| 525-549 | - | - | - | - | - | 7 | 11 | - | - | 18 |
| 550-574 | - | - | - | - | - | 6 | 16 | - | - | 22 |
| 575-599 | - | - | - | - | - | 6 | 16 | - | - | 22 |
| 600-624 | - | - | - | - | - | 1 | 13 | 4 | - | 18 |
| 625-649 | - | - | - | - | - | 4 | 8 | 1 | - | 13 |
| 650-674 | - | - | - | - | - | 1 | 2 | 6 | - | 9 |
| 675-699 | - | - | - | - | - | - | 4 | 5 | 1 | 10 |
| 700-724 | - | - | - | - | - | - | - | 1 | - | 1 |
| 725-749 | - | - | - | - | - | - | - | - | 1 | 1 |
| 750-774 | - | - | - | - | - | - | - | - | - | - |
| 775-799 | - | - | - | - | - | - | - | 1 | - | 1 |
| Total | 5 | 79 | 268 | 216 | 72 | 79 | 83 | 18 | 2 | 822* |
| Length | | | | | | | | | | |
| Range (mm) | 117-151 | 140-203 | 171-259 | 204-344 | 270-518 | 326-650 | 477-689 | 604-775 | 693-737 | 117-775 |
| Mean Length (mm) | 143 | 179 | 216 | 268 | 351 | 489 | 579 | 664 | 715 | 311 |
| % of Total | 0.6 | 9.6 | 32.6 | 26.3 | 8.8 | 9.6 | 10.1 | 2.2 | 0.2 | 100.0 |
| Mean Growth | | | | | | | | | | |
| Increment (mm) | 36 | 37 | 52 | 83 | 138 | 90 | 85 | 51 | | |

* Includes 13 hook and line sampled rainbow trout.

Of 1,601 rainbow trout captured by weir traps, 312 (19.5%) had observed scale loss. Of these fish, 141 were considered in critical condition, with 77 (5.5%) dead or dying as a direct result of abrasion and scale loss. A redesign of the upstream migrant fyke trap is in progress to minimize mortalities due to abrasion.

Weir sampling permitted detailed physical examination of all rainbow trout captured. Rainbow trout physical injuries and abnormalities observed and noted are presented in Table 11.

Incidental Species:

Total numbers of fish passed through the permanent weir, enumerated by species, are shown in Table 12.

Table 12 Upstream and Downstream Migrant Fish by Species, Lower Talarik Creek Permanent Weir, July 21-October 5, 1972.

| <u>Species</u> | <u>Numbers</u> | | <u>Total</u> |
|---|--------------------------|----------------------------|----------------|
| | <u>Upstream Migrants</u> | <u>Downstream Migrants</u> | |
| Arctic grayling, <u>Thymallus arcticus</u> | 632 | 175 | 807 |
| Round Whitefish, <u>Prosopium cylindraceum</u> | 52 | 30 | 82 |
| Dolly Varden/Arctic char, <u>Salvelinus malma/alpinus</u> | 6 | 3 | 63 |
| Red salmon, <u>Oncorhynchus nerka</u> | 6,000 + | -- | 6,000 +* |
| Silver salmon, <u>O. kisutch</u> | 3 | -- | 3 |
| King salmon, <u>O. tshawytscha</u> | 2 | -- | 2 |
| Pink salmon, <u>O. gorbuscha</u> | 4 | -- | 4 |
| Northern pike, <u>Esox lucius</u> | 3 | -- | 3 |
| Long nose sucker, <u>Catostomus catostomus</u> | 605 | -- | 605 |
| Total | <u>7,361 +</u> | <u>208</u> | <u>7,569 +</u> |

*Estimated

Other incidental species observed or trapped were: threespined sticklebacks, Gasterosteus aculeatus; pond smelt, Hypomesus olidus; and members of the family Cottidae. No attempt was made to enumerate these species.

Arctic grayling were the third dominant species passing through the weir. A length frequency of upstream and downstream migrants is presented in Table 13.

TABLE 11. Physical Abnormalities and Injuries of Rainbow Trout
Observed at Lower Talarik Creek Permanent Weir,
July 21 - October 5, 1972.

| <u>Physical Deviations</u> | <u>Number</u> |
|----------------------------|---------------|
| Lamprey scars | 1 |
| Fungus (fins) | 10 |
| Fungus (body) | 10 |
| Lacerations (body) | 35 |
| Lacerations (snout) | 21 |
| Dentary injury | 8 |
| Caudal injury | 48 |
| Mouth injury | 66 |
| Opercle injury | 9 |
| Fin injury | 20 |
| Hooking injury | 7 |
| Net marks | 4 |
| Bleeding (tag wound) | 4 |
| Deformed caudal | 2 |
| Deformed backbone | <u>2</u> |
| Total | 247 |

TABLE 13. Arctic Grayling Length Frequency (Upstream and Downstream Migrants), Lower Talarik Creek Permanent Weir, July 21-October 5, 1972.

| <u>Length (mm)</u> | <u>Upstream Migrants</u> | <u>Downstream Migrants</u> | <u>Total</u> |
|--------------------|--------------------------|----------------------------|--------------|
| 125-149 | 25 | 10 | 35 |
| 150-174 | 21 | 10 | 31 |
| 175-199 | 39 | 19 | 58 |
| 200-224 | 61 | 24 | 85 |
| 225-249 | 30 | 9 | 39 |
| 250-274 | 90 | 22 | 112 |
| 275-299 | 106 | 35 | 141 |
| 300-324 | 138 | 24 | 162 |
| 325-349 | 84 | 16 | 100 |
| 350-374 | 33 | 6 | 39 |
| 375-399 | <u>5</u> | <u>-</u> | <u>5</u> |
| Total | 632 | 175 | 807 |
| Length Range (mm) | 125-387 | 132-365 | 125-387 |
| Mean Length (mm) | 273 | 251 | 268 |
| % of Total | 78.3 | 21.7 | 100.0 |

Creel Census:

Creel census activities were conducted from June 17 through October 23 to determine estimates of sport harvest, catch and release ratios, gear preference, and man-hours expended.

Prior to weir construction, rainbow trout were sampled from the sport creel to determine age, length and sex ratios. Maximum age and length recruited to the sport angler harvest was determined.

Comparative rainbow trout creel census data collected from 1970 - 1972 is shown in Table 14.

TABLE 14 Rainbow Trout Creel Census Data Collected from August 26 through October 11 at Lower Talarik Creek, 1970 - 1972.

| Year | <u>Fishermen</u> | | <u>Hours</u> | <u>Rainbow Trout Catch</u> | <u>Catch/Angler Hour</u> | <u>Rainbow Trout Retained</u> |
|------|------------------|----------------|--------------|----------------------------|--------------------------|-------------------------------|
| | <u>Observed</u> | <u>Checked</u> | | | | |
| 1970 | 302 | 244 | 1,315.5 | 600 | 0.46 | 119 (19.8%) |
| 1971 | 267 | 223 | 1,117.0 | 1,055 | 0.95 | 174 (16.5%) |
| 1972 | 104 | 65 | 407.0 | 94 | 0.23 | 21 (22.3%) |

Catch per unit of effort for August 26-October 11, 1972, was the lowest recorded in three years.

Season total of 316 anglers were observed during the 129-day period with peak fishing pressure occurring during June. An estimated 760 rainbow trout were caught, 617 (81.2%) released, and 143 (18.8%) retained (Table 15).

The estimated 1972 seasonal catch per unit of effort was 0.46 rainbow trout per hour, which is a marked decrease from the 0.88 rainbow trout catch per hour for 1971 (Siedelman; Cunningham, 1972).

Of the observed seasonal catch of 619 rainbow trout, 93 (15.0%) were sampled during the period from June 8 through July 5. Of the 93 sampled, 24 (25.8%) were over 508 mm (20 inches) in length. Sex determinations were made on 83 of the 93 rainbow trout sampled. The rainbow trout male- to-female sex ratio was 46:37 (1.2:1) (Table 16).

Sixty of the 93 rainbow trout scales were legible for age determination (Table 17). Age classes VI and VII constituted 71.7% (43) of the age classes represented. Age VI and VII rainbow trout dominated the June 8 - July 5 sport harvest. Twenty-five (26.9%) of the fish sampled were post-spawners. Average lengths for age VI and VII are less than the 508 mm length required for a "trophy fish" length.

TABLE 15 Rainbow Trout Creel Census Data, Lower Talarik Creek, June 17 - October 23, 1972.

| Month | Anglers | Anglers | Checked | No. Fish Caught | | No. Angler Hours | | Catch/Hour | Catch/Release | Lure/Fly |
|-------|-----------|----------|-------------|-----------------|----------|------------------|-----------|-------------------|-----------------|------------------|
| | Observed | Checked | | Observed | Expanded | Observed | Expanded | | | |
| June | 144 | 121 | 84.0 | 489 | 582 | 690 | 821 | 582/821(0.71) | 582/110(5.29) | 90/33(2.73) |
| July | 49 | 32 | 65.3 | 49 | 75 | 227 | 348 | 75/348(0.22) | 75/15(5.0) | 30/9(3.33) |
| Aug. | 33 | 28 | 84.8 | 64 | 76 | 92 | 108 | 76/108(0.70) | 76/13(5.85) | 19/16(1.18) |
| Sept. | 80 | 60 | 75.0 | 14 | 19 | 260 | 347 | 19/347(0.05) | 19/4(4.75) | 34/46(0.73) |
| Oct. | <u>10</u> | <u>4</u> | <u>40.0</u> | <u>3</u> | <u>8</u> | <u>11</u> | <u>28</u> | <u>8/28(0.29)</u> | <u>8/1(8.0)</u> | <u>2/5(0.40)</u> |
| Total | 316 | 245 | 77.5 | 619 | 760 | 1,280 | 1,652 | 760/1652(0.46) | 760/143(5.31) | 175/109(1.61) |

TABLE 16 Length Frequency of Sport Caught Rainbow Trout by Sex,
Lower Talarik Creek, June 8 - July 5, 1972.

| Length (mm) | Sex | | | Total |
|-------------------|---------|---------|---------|---------|
| | Male | Female | Unknown | |
| 250-274 | - | 2 | - | 2 |
| 275-299 | - | - | - | - |
| 300-324 | 4 | - | 3 | 7 |
| 325-349 | 5 | 1 | - | 6 |
| 350-374 | 1 | 1 | - | 2 |
| 375-399 | 6 | 7 | 2 | 15 |
| 400-424 | 10 | 2 | 1 | 13 |
| 425-449 | 2 | 6 | - | 8 |
| 450-474 | 5 | 4 | 2 | 11 |
| 475-499 | 1 | 2 | - | 3 |
| 500-524 | 1 | 1 | - | 2 |
| 525-549 | 1 | 1 | 1 | 3 |
| 550-574 | - | 3 | - | 3 |
| 575-599 | - | 1 | - | 1 |
| 600-624 | 1 | 2 | - | 3 |
| 625-649 | 1 | 4 | - | 5 |
| 650-674 | 1 | - | - | 1 |
| 675-699 | 1 | - | - | 1 |
| 700-724 | 3 | - | - | 3 |
| 725-749 | 2 | - | - | 2 |
| 750-774 | - | - | - | - |
| 775-799 | - | - | - | - |
| 800-824 | 1 | - | - | 1 |
| Total | 46 | 37 | 9 | 92 |
| Length Range (mm) | 310-814 | 254-647 | 300-534 | 254-814 |
| Mean Length (mm) | 467 | 469 | 396 | 461 |

TABLE 17 Sport Caught Rainbow Trout Length Frequency, by Age, Lower Talarik Creek, June 8 - July 5, 1972.

| Length (mm) | Age Class | | | | | Tot. |
|------------------|-----------|---------|---------|---------|---------|---------|
| | V | VI | VII | VIII | IX | |
| 250-274 | 1 | - | - | - | - | 1 |
| 275-299 | - | - | - | - | - | - |
| 300-324 | 3 | 3 | - | - | - | 6 |
| 325-349 | - | 3 | 2 | - | - | 5 |
| 350-374 | - | 1 | - | - | - | 1 |
| 375-399 | - | 2 | 5 | 1 | - | 8 |
| 400-424 | - | 6 | 3 | 1 | - | 10 |
| 425-449 | - | 1 | 4 | - | - | 5 |
| 450-474 | - | 1 | 7 | 1 | - | 9 |
| 475-499 | - | - | 2 | 1 | - | 3 |
| 500-524 | - | - | 2 | - | - | 2 |
| 525-549 | - | - | - | 1 | - | 1 |
| 550-574 | - | - | 1 | 2 | - | 3 |
| 575-599 | - | - | - | - | - | - |
| 600-624 | - | - | - | - | 2 | 2 |
| 625-649 | - | - | - | - | 2 | 2 |
| 650-674 | - | - | - | - | 1 | 1 |
| 675-699 | - | - | - | - | 1 | 1 |
| Total | 4 | 17 | 26 | 7 | 6 | 60 |
| Length | | | | | | |
| Range (mm) | 254-312 | 302-453 | 329-569 | 399-571 | 612-685 | 254-685 |
| Mean Length (mm) | 294 | 382 | 439 | 488 | 645 | 440 |
| % of Total | 6.7 | 28.3 | 43.3 | 11.7 | 10.0 | 100.0 |

Copper River

Rainbow Trout:

A rainbow trout investigational program was initiated on the Copper River in an effort to expand knowledge of this important game fish and its utilization in the Bristol Bay area. Investigations were conducted on this tributary to Lake Iliamna (Figure 4) from April 26 through October 11, 1972. Estimates of the spawning population, monitoring migrations, obtaining age-weight-length data, and gathering angler use, and angler expense data was achieved.

Spring Spawning Activities:

Prespawn rainbow trout were first observed in Copper River on May 15. Ice fishing, gillnetting and stream surveys prior to this date failed to yield evidence of prespawning rainbow trout in the lower river areas (sections 1-7, Figure 4). The prespawners observed on May 15 appeared to have just migrated into the stream from Lake Iliamna.

Paired rainbow trout spawners were noted first on May 30 in sections 4 and 5 (Figure 4). Foot survey counts indicated peak spawning occurred from June 3 through June 7, when a minimum of 630 rainbow trout spawners were observed. Their distribution, by stream section during this count, is presented in Table 18. Subsequent counts throughout the section 5 index area (east bank of river throughout section 5) indicated the number of rainbow trout spawners decreased from 151 (June 5) to 84 (June 12), and to 25 by June 18. No rainbow trout spawning activity was observed in the river after June 22.

The total Copper River rainbow trout spawning run for 1972 was estimated at between 750 and 1,000 fish. Following spawning, some "spent" rainbow trout returned to Lake Iliamna while others remained in the river (refer to tagging section).

Water temperatures (June 2 - June 22) ranged from 3.9°C (prior to June 2, water temperatures were not taken).

A total of 226 rainbow trout spawners were sampled prior to, during, and after the spawning season. The length frequency by sex of these spawners is presented in Table 19. The mean lengths of spawning male and female rainbow trout were 512 mm, and 485 mm, respectively. The largest (652 mm) and smallest (373 mm) spawners were both males. Of the 226 spawners sampled, 137 (60.6%) were females and 89 (39.4%) were males. The male-to-female sex ratio was 89:137 (0.6:1).

Age frequency by sex for rainbow trout spawners is presented in Table 20. Scale samples taken from the above 226 rainbow trout were read; 117 (51.8%) of these were legible. Male spawners (49 samples) ranged in age from VI to X. Female spawners (68 samples) ranged in age from VII to X. Age VIII (48.7%) and age IX (26.5%) rainbow trout constituted 75.2% of the spawning population.

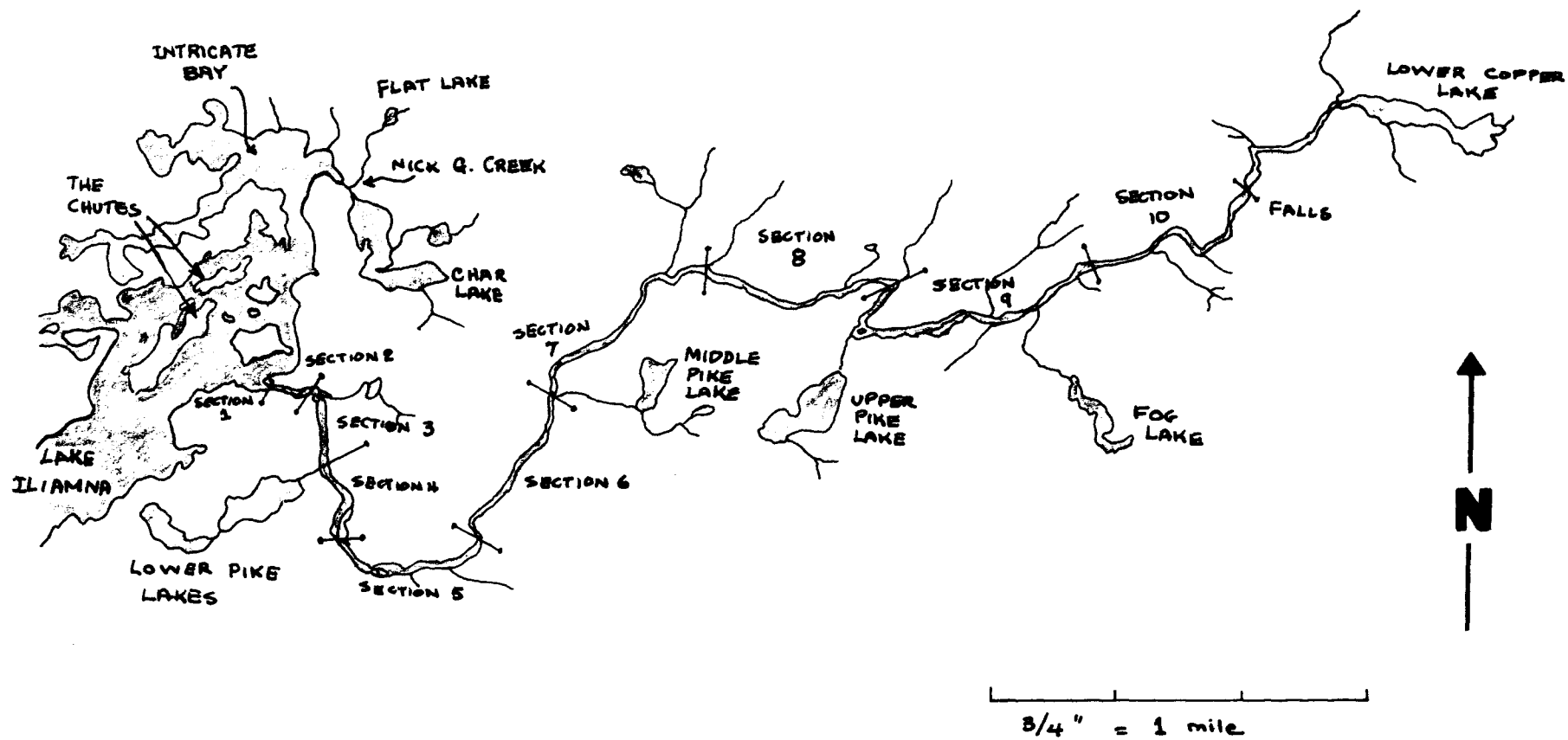


FIGURE 4 Rainbow Trout Sampling Areas, Copper River, Nick G. Creek 1972

TABLE 18 Rainbow Trout Spawning Distribution, by Section, Copper River, June 5 - June 7, 1972.

| <u>Section</u> | <u>Copper River</u> | | <u>Number</u> | <u>Total</u> |
|----------------|---------------------|----------------|---------------|----------------|
| | <u>E. Side</u> | <u>W. Side</u> | | <u>Percent</u> |
| 1 | - | - | - | - - |
| 2 | 0 | 0 | 0 | - - |
| 3 | 0 | 0 | 0 | - - |
| 4 | 0 | 10 | 10 | (1.6) |
| 5 | 141 | 54 | 195 | (31.0) |
| 6 | 111 | 46 | 157 | (25.0) |
| 7 | 33 | 16 | 49 | (7.8) |
| 8 | 7 | 34 | 41 | (6.5) |
| 9 | 40 | 70 * | 110 | (17.5) |
| 10 | <u>40</u> | <u>28 **</u> | <u>68</u> | <u>(10.8)</u> |
| Total | 372 | 258 | 630 | (100.2) |

* Includes 14 rainbow trout observed in a tributary stream.

** Includes 1 rainbow trout observed in a tributary stream.

TABLE 19 Spawning Rainbow Trout Length Frequency by Sex, Copper River, May 15 - October 9, 1972. *

| <u>Length (mm)</u> | <u>Sex by Spawner</u> | | <u>Total</u> |
|--|-----------------------|----------------|--------------|
| | <u>Males</u> | <u>Females</u> | |
| 350-374 | 1 | - | 1 |
| 375-399 | - | 1 | 1 |
| 400-425 | 2 | 3 | 5 |
| 425-449 | 8 | 25 | 33 |
| 450-474 | 12 | 33 | 45 |
| 475-499 | 12 | 30 | 42 |
| 500-524 | 19 | 21 | 40 |
| 525-549 | 15 | 8 | 23 |
| 550-574 | 9 | 9 | 18 |
| 575-599 | 5 | 5 | 10 |
| 600-624 | 5 | 2 | 7 |
| 625-649 | - | - | - |
| 650-674 | <u>1</u> | <u>-</u> | <u>1</u> |
| Total | 89 | 137 | 226 |
| Length Range (mm) | 373-652 | 391-616 | 373-652 |
| Mean Length (mm) | 512 | 485 | 496 |
| * Includes prespawners, spawners, and post spawners sampled by Department personnel during tagging program and from the sportsman's bag. | | | |

TABLE 20 Spawning Rainbow Trout Age Frequency by Sex, Copper River, May 15 - October 9, 1972.

| <u>Age Class</u> | <u>Male</u> | | <u>Female</u> | | <u>Total</u> | |
|------------------|-------------|---------------|---------------|--------------|--------------|---------------|
| | <u>No.</u> | <u>(%)</u> | <u>No.</u> | <u>(%)</u> | <u>No.</u> | <u>(%)</u> |
| VI | 1 | (2.0) | - | - | 1 | (0.9) |
| VII | 7 | (14.3) | 8 | (11.7) | 15 | (12.8) |
| VIII | 16 | (32.7) | 41 | (60.3) | 57 | (48.7) |
| IX | 16 | (32.7) | 15 | (22.1) | 31 | (26.5) |
| X | <u>9</u> | <u>(18.4)</u> | <u>4</u> | <u>(5.9)</u> | <u>13</u> | <u>(11.1)</u> |
| Total | 49 | (100.1) | 68 | (100.0) | 117 | (100.0) |

* Includes prespawners, spawners, and post spawners sampled by Department personnel during tagging program, and from the sportsman's bag.

Migration and Timing:

Following the spawning run, immature lake-run rainbow trout (silvery) began to appear in Copper River during early June (care was exercised not to include these fish in the counts of spawning rainbow trout). This appeared to have been a feeding migration.

The main Copper River sockeye salmon immigration occurred from July 12 - August 15. During this period, rainbow trout moved from deep water areas throughout the river into the swifter, shallower runs where they remained the duration of the salmon spawning period. During salmon spawning, both juvenile and adult rainbow trout were observed among the sockeye salmon redds competing with char for salmon eggs and invertebrates.

On July 28, in a side channel of the river in section 9, rainbow trout fry were first observed. They were observed again on August 6 inside channels of sections 4 and 5. These fry were found stranded in scattered pools along dried side channels used earlier for spawning by rainbow trout. Due to the fact that rainbow trout spawning was observed in these channels, it appears that there was an estimated 50-day interval between peak of rainbow trout spawning (June 3 - June 7) and the first observed post-emergent fry. Further fry emergence observations were lost when rains during August flooded these side channels. Silvery, robust fall-run rainbow trout began entering Copper River from Lake Iliamna in late August. The immigration continued into mid-October (program termination). During this period, an estimated 125-200 of these large lake-run fish entered the river. Samples of this group from the angler creels indicated it was comprised of both immature and maturing (would spawn the following spring) rainbow trout.

Observations indicated an outmigration into Lake Iliamna of slender, dark (stream color) rainbow trout during September and October. Several of these sampled from the angler bag, or during hook and line tagging, had been spawning during the spring and had apparently remained in the stream. A numerical estimate of the outmigration was not obtained.

During early September, juvenile rainbow trout disappeared from the shallow waters of the main river and from the angler bag. These fish, predominantly 300-350 mm in length, became scarce during the main sockeye salmon "die-off" period.

In an effort to capture young-of-the-year rainbow trout, portions of side channels in sections 4 and 5 were sampled with a back-pack electroshocker on October 7. A sample of 31 rainbow trout fry and 14 rainbow trout fingerlings was obtained. These fish ranged in length from 31-119 mm.

Age, Weight, Length Relationships:

Seven hundred five rainbow trout were sampled in Copper River during 1972. Length frequency of these fish is presented in Table 21. These rainbow trout ranged in length from 31 - 652 mm with a mean length of 409 mm. Of the 705 rainbow trout sampled, 517 (73.3%) yielded legible scales. The length-age relationships of these 517 rainbow trout are presented in Table 22. Those rainbow trout aged ranged from age group

TABLE 21 Rainbow Trout Length Frequency by Capture Method, Copper River,
May 3 - October 9, 1972.

| Length (mm) | Capture Method | | | Tot. |
|-------------------|--|--|--------------------------|----------|
| | Hook & Line (Dept.)* (May 3-Oct. 9) | Hook & Line (Sportsmen) (May 29-Oct. 3) | Electroshock (Oct. 7) | |
| 25-49 | - | - | 30 | 30 |
| 50-74 | - | - | 7 | 7 |
| 75-99 | 1 | - | 7 | 8 |
| 100-124 | 4 | - | 1 | 5 |
| 125-149 | 6 | - | - | 6 |
| 150-174 | 2 | 1 | - | 3 |
| 175-199 | 10 | - | - | 10 |
| 200-224 | 10 | 1 | - | 11 |
| 225-249 | 14 | 3 | - | 17 |
| 250-274 | 7 | 2 | - | 9 |
| 275-299 | 8 | 4 | - | 12 |
| 300-324 | 8 | 4 | - | 12 |
| 325-349 | 11 | 6 | - | 17 |
| 350-374 | 16 | 12 | - | 28 |
| 375-399 | 34 | 8 | - | 42 |
| 400-424 | 25 | 30 | - | 55 |
| 425-449 | 45 | 40 | - | 85 |
| 450-474 | 70 | 30 | - | 100 |
| 475-499 | 56 | 25 | - | 81 |
| 500-524 | 43 | 20 | - | 63 |
| 525-549 | 36 | 14 | - | 50 |
| 550-574 | 18 | 7 | - | 25 |
| 575-599 | 11 | 5 | - | 16 |
| 600-624 | 9 | - | - | 9 |
| 625-649 | 1 | 2 | - | 3 |
| 650-674 | <u>1</u> | <u>-</u> | <u>-</u> | <u>1</u> |
| Total | 446 | 214 | 45 | 705 |
| Length Range (mm) | 84-652 | 170-647 | 31-119 | 31-652 |
| Mean Length (mm) | 428 | 445 | 52 | 409 |

* Includes 3 stream dead

TABLE 22 Rainbow Trout Length-Age, from Electroshock and Hook and Line Samples, Copper River, May 3 - October 9, 1972.

| Length (mm) | Age Group | | | | | | | | | | | Tot. |
|-----------------------|-----------|-------|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|
| | 0 | I | II | III | IV | V | VI | VII | VIII | IX | X | |
| 25-49 | 30 * | - | - | - | - | - | - | - | - | - | - | 30 |
| 50-74 | 1 * | 6 * | - | - | - | - | - | - | - | - | - | 7 |
| 75-99 | - | - | 8** | - | - | - | - | - | - | - | - | 8 |
| 100-124 | - | - | 1* | 1 | - | - | - | - | - | - | - | 2 |
| 125-149 | - | - | - | 5 | - | - | - | - | - | - | - | 5 |
| 150-174 | - | - | - | 2 | - | - | - | - | - | - | - | 2 |
| 175-199 | - | - | - | 3 | 6 | - | - | - | - | - | - | 9 |
| 200-224 | - | - | - | - | 6 | 3 | - | - | - | - | - | 9 |
| 225-249 | - | - | - | - | 4 | 10 | - | - | - | - | - | 14 |
| 250-274 | - | - | - | - | - | 8 | - | - | - | - | - | 8 |
| 275-299 | - | - | - | - | - | 10 | 1 | - | - | - | - | 11 |
| 300-324 | - | - | - | - | - | 4 | 8 | - | - | - | - | 12 |
| 325-349 | - | - | - | - | - | 1 | 15 | 1 | - | - | - | 17 |
| 350-374 | - | - | - | - | - | - | 22 | 3 | - | - | - | 25 |
| 375-399 | - | - | - | - | - | - | 9 | 24 | - | - | - | 33 |
| 400-424 | - | - | - | - | - | - | - | 37 | 8 | - | - | 45 |
| 425-449 | - | - | - | - | - | - | - | 44 | 19 | - | - | 63 |
| 450-474 | - | - | - | - | - | - | - | 3 | 64 | - | - | 67 |
| 475-499 | - | - | - | - | - | - | - | 1 | 46 | 5 | - | 52 |
| 500-524 | - | - | - | - | - | - | - | - | 11 | 20 | - | 31 |
| 525-549 | - | - | - | - | - | - | - | - | - | 31 | 1 | 32 |
| 550-574 | - | - | - | - | - | - | - | - | 1 | 9 | 3 | 13 |
| 575-599 | - | - | - | - | - | - | - | - | - | - | 11 | 11 |
| 600-624 | - | - | - | - | - | - | - | - | - | - | 7 | 7 |
| 625-649 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |
| 650-674 | - | - | - | - | - | - | - | - | - | - | 1 | 1 |
| Total | 31 | 6 | 9 | 11 | 16 | 36 | 55 | 113 | 149 | 65 | 26 | 517 |
| Length Range (mm) | 31-53 | 66-74 | 76-119 | 124-187 | 190-237 | 222-334 | 293-391 | 349-479 | 401-575 | 481-568 | 526-652 | 31-652 |
| Mean Length | 40 | 71 | 85 | 154 | 212 | 263 | 351 | 416 | 467 | 527 | 598 | |
| Growth Increment (mm) | 31 | 14 | 69 | 58 | 51 | 88 | 65 | 51 | 60 | 71 | | |

* Electroshocked fish

** Includes seven electroshocked fish

0 (young-of-the-year) through X. Based on 31 young-of-the-year rainbow trout aged, initial scale formation occurred at lengths from 33 - 39 mm. Readings from 14 of the 15 age I and age II rainbow trout indicated that the number of circuli, laid down prior to the appearance of the first annular ring, varied from three to eight during 1970 and 1971.

A total of 130 rainbow trout were sampled from weight during 1972. The length-weight relationship of these fish appears in Table 23. Copper River rainbow trout weights ranged from 0.11 to 3.35 kg with a mean weight of 0.95 kg.

Tag Recoveries:

Three hundred sixty-seven rainbow trout were tagged and released in Copper River during 1972. Of these, 28 (7.6%) were recovered during 1972; 21 (5.7%) were recovered in Copper River. Seven of the fish recovered in the river had moved upstream, six were recovered in the section where tagged, and eight had moved downstream.

Four of the seven tagged upstream migrant rainbow trout were prespawners (prior to June 18). These four were captured during July and August as "spent" fish in sections 5 and 6 indicating that some of the spring spawners remained in the river following spawning. In addition, three "spent" rainbow trout tagged in sections 5, 6, and 7 during July and mid-August were recovered during late August and September as downstream migrants in the lower sections of Copper River.

Seven rainbow trout tagged in the river during 1972 were recaptured outside the Copper River drainage during 1972. Six of these fish were Copper River spawners; three were captured prior to mid-August and three were captured in late September. The three captured prior to mid-August indicate that some of the Copper River spawners do not over-summer in the stream following spawning. Recovery locations outside the Copper River drainage were at Igiugig (1), Gibraltar River mouth area (2), Kokhonak Village (1), Kokhonak River mouth area (2), and Pedro Bay (1) (Figure 3). Two rainbow trout tagged in previous years (one each in 1969 and 1970) were recovered in the river during 1972. A summary of rainbow trout movement patterns in the Lake Iliamna-Kvichak River system, based on tag recovery data (1964-72), is presented in Figure 3.

Stomach Analysis:

From May 31 through October 3, 1973, a total of 66 rainbow trout, either retained by angler or sacrificed by Department personnel, were sampled for stomach contents. The rainbow trout sampled ranged in length from 149-628mm. Food types noted are presented in Table 24. The most common food items present in the stomachs were caddis fly larvae (Trichoptera), decomposing sockeye salmon flesh, and sockeye salmon eggs. The caddis fly larvae were found in stomachs throughout the sampling period. Salmon eggs were first noted in a rainbow trout stomach on August 15. Decomposing sockeye salmon flesh was noted first in a September 5 stomach sample.

TABLE 23 Rainbow Trout Length-Weight from Hook & Line Samples, Copper River,
June 24 - October 3, 1972.

| Length (mm) | 0.01- 0.49 | 0.50- 0.99 | 1.00- 1.49 | 1.50- 1.99 | 2.00- 2.49 | 2.50- 2.99 | 3.00- 3.49 | Tot. |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 200-224 | 3 | - | - | - | - | - | - | 3 |
| 225-249 | 3 | - | - | - | - | - | - | 3 |
| 250-274 | 1 | - | - | - | - | - | - | 1 |
| 275-299 | 5 | - | - | - | - | - | - | 5 |
| 300-324 | 3 | - | - | - | - | - | - | 3 |
| 325-349 | 3 | 1 | - | - | - | - | - | 4 |
| 350-374 | 1 | 7 | - | - | - | - | - | 8 |
| 375-399 | - | 4 | - | - | - | - | - | 4 |
| 400-424 | - | 15 | - | - | - | - | - | 15 |
| 425-449 | - | 20 | - | - | - | - | - | 20 |
| 450-474 | - | 11 | 5 | - | - | - | - | 16 |
| 475-499 | - | 4 | 14 | - | - | - | - | 18 |
| 500-524 | - | - | 12 | 2 | - | - | - | 14 |
| 525-549 | - | - | - | 7 | 1 | - | - | 8 |
| 550-574 | - | - | - | 4 | - | - | - | 4 |
| 575-599 | - | - | - | 2 | - | - | - | 2 |
| 600-624 | - | - | - | - | - | - | - | - |
| 625-649 | - | - | - | - | - | - | 2 | 2 |
| Totals | 19 | 62 | 31 | 15 | 1 | - | 2 | 130 |
| Weight Range (kg) | 0.11- 0.45 | 0.51- 0.99 | 1.02- 1.47 | 1.50- 1.98 | 2.16 | - | 3.01- 3.35 | 0.11- 3.35 |
| Mean Weight (kg) | 0.25 | 0.78 | 1.17 | 1.69 | 2.16 | - | 3.18 | 0.95 |

TABLE 24 Rainbow Trout Food Items and their Frequency of Occurrence in Stomachs Sampled, Copper River, May 21 - October 3, 1972.

| <u>Food Items</u> | <u>Frequency of*</u> <u>Occurrence</u> | <u>% of **</u> | |
|------------------------------------|---|----------------|-----------------------------|
| | | <u>Tot.</u> | <u>Period of Occurrence</u> |
| Caddis fly (Trichoptera) larvae | 23 | 34.8 | June 11-September 26 |
| Sockeye salmon remains | 21 | 31.8 | September 5-October 3 |
| Sockeye salmon eggs | 11 | 16.6 | August 15-September 23 |
| Stone fly (Plecoptera) nymphs | 6 | 9.1 | May 21-August 6 |
| Alder fly (Megaloptera) adults | 4 | 6.0 | July 2-September 7 |
| May fly (Ephemeroptera) nymphs | 4 | 6.0 | July 9-July 31 |
| Aquatic Diptera adults | 3 | 4.5 | June 24-September 6 |
| Aquatic Diptera larvae | 2 | 3.0 | September 3-September 6 |
| Aquatic Hemiptera adults | 2 | 3.0 | September 6-September 20 |
| Caddis fly (Trichoptera) adults | 1 | 1.5 | September 7- |
| Stone fly (Plecoptera) adults | 1 | 1.5 | September 6- |
| May fly (Ephemeroptera) adults | 1 | 1.5 | July 21- |
| Forage fishes | 1 | 1.5 | September 3 |
| Leech | 1 | 1.5 | September 20 |
| Small mammals (shrew) | 1 | 1.5 | September 24 |
| Eggskeins of recently cleaned fish | 1 | 1.5 | June 15 |
| Empty stomach | 9 | 13.6 | June 17-September 28 |

* Frequency of occurrence denotes the number of stomachs in which each food item appeared.

** Based on 66 stomachs sampled.

Creel Census:

Creel census activities were conducted from May 29 through October 3 to compile estimates of the Copper River sport catch, angler effort, catch and release ratios, and gear preference. Rainbow trout retained were sampled for length, weight, sex, and maturity.

A total of 269 anglers fished Copper River and observed 833 angler days. Of the 833 angler days observed, 696 (83.6%) were checked by Department personnel. Rainbow trout catch per hour was 0.92 for the period censused. A total of 3,612 rainbow trout were caught, and 529 were retained for a retain-release ratio of 1:7. Creel census totals by month are presented in Table 25.

The length frequency of 214 rainbow trout sampled from the angler creel is presented in Table 19. Angler retained rainbow trout ranged in length from 170-647 mm with an average length of 445 mm.

Ages were determined for 168 (78.5%) of the 214 angler-caught rainbow trout. The length versus age of rainbow trout recruited to the angler creel is presented in Table 26. The ages ranged from III to X. Of the 168 rainbow trout aged, 135 (80.4%) were age VII or older.

Anglers fishing Copper River used three types of terminal gear: flies, lures, and bait. The use of bait was legal prior to June 8, and illegal thereafter through October 31. For comparisons of the effectiveness of flies and lures as terminal tackle during 1972, refer to Table 27. All totals used are actual (not expanded). All data presented was obtained from anglers through the creel census program. The data taken during 1972 indicated that the fly fishery and lure fishery caught 1.11 and 0.54 rainbow trout per hour, respectively (Table 25). The average number of rainbow trout retained per angler hour by fly fishermen was 0.07. The corresponding average number of rainbow trout retained per angler hour by lure fishermen was 0.21. Anglers using lures retained three times the number of rainbow trout per fishing hour than anglers using flies (Table 27).

Economic Evaluation of the Sport Fishery:

Department personnel conducted an economic evaluation of the Copper River sport fishery between May 29 and October 3, 1972. A total of 236 anglers were surveyed to determine the expenses incurred.

Anglers arriving at Copper River were asked by Department personnel to volunteer information on the monetary expenditures incurred and anticipated while on their sport fishing trip. Information volunteered included place of residence, type of transportation to and from Copper River, type and location of lodging utilized, length of stay, professional services used, and miscellaneous expenditures made during the trip (Figure 5). All expenditures made in travelling to and from Copper River were included, except in those cases where the primary purpose of the individual's trip may not have been simply to fish Copper River; in those cases, only the expenses to and from Copper River, from the Alaska point of origin were included. State residence was noted to determine the economic contributions of resident versus nonresident anglers.

TABLE 25 Creel Census Totals by Month, Copper River, May 29 - October 3, 1972.

| | Months | | | | | | Season's Tot. |
|-------------------------------------|------------|-------------|-------------|---------------|------------------|----------------|------------------|
| | <u>May</u> | <u>June</u> | <u>July</u> | <u>August</u> | <u>September</u> | <u>October</u> | |
| Total angler days observed | 2 | 85 | 351 | 156 | 230 | 9 | 833 |
| Total angler days checked | 2 | 49 | 264 | 152 | 220 | 9 | 696 |
| % angler days checked | 100.0 | 57.6 | 75.2 | 97.4 | 95.6 | 100.0 | 83.6 |
| Angler hours expended (actual) | 5 | 184 | 1,332 | 776 | 952 | 33 | 3,282 |
| Angler hours expended (expanded) | 5 | 319 | 1,771 | 796 | 995 | 33 | 3,919 |
| No. rainbow trout caught (actual) | 4 | 203 | 1,079 | 912 | 826 | 21 | 3,045 |
| No. rainbow trout caught (expanded) | 4 | 352 | 1,435 | 936 | 864 | 21 | 3,612 |
| Rainbow trout catch/hour* | 0.80 | 1.10 | 0.81 | 1.18 | 0.87 | 0.64 | 0.92 |
| Rainbow trout retained (actual) | 4 | 33 | 209 | 67 | 113 | 3 | 429 |
| Rainbow trout retained (expanded) | 4 | 57 | 278 | 69 | 118 | 3 | 529 |
| Rainbow trout retained/caught | 1/1 | 1/6 | 1/5 | 1/14 | 1/7 | 1/7 | 1/7 |

* Computed using expanded figures

TABLE 26. Sport Caught Rainbow Trout Length Frequency, by Age, Recruited to the Angler Creel, Copper River, May 29-October 3, 1972.

| Length (mm) | Age Class | | | | | | | | Tot. |
|-------------------|-----------|-----|---------|---------|---------|---------|---------|---------|---------|
| | III | IV | V | VI | VII | VIII | IX | X | |
| 150-174 | 1 | - | - | - | - | - | - | - | 1 |
| 174-199 | - | - | - | - | - | - | - | - | - |
| 200-224 | - | 1 | - | - | - | - | - | - | 1 |
| 225-249 | - | - | 2 | - | - | - | - | - | 2 |
| 250-274 | - | - | 1 | - | - | - | - | - | 1 |
| 275-299 | - | - | 3 | - | - | - | - | - | 3 |
| 300-324 | - | - | 2 | 2 | - | - | - | - | 4 |
| 325-349 | - | - | - | 6 | - | - | - | - | 6 |
| 350-374 | - | - | - | 12 | - | - | - | - | 12 |
| 375-399 | - | - | - | 3 | 5 | - | - | - | 8 |
| 400-424 | - | - | - | - | 21 | 2 | - | - | 23 |
| 425-449 | - | - | - | - | 27 | 6 | - | - | 33 |
| 450-474 | - | - | - | - | 2 | 19 | - | - | 21 |
| 475-499 | - | - | - | - | - | 17 | 2 | - | 19 |
| 500-524 | - | - | - | - | - | 2 | 11 | - | 13 |
| 525-549 | - | - | - | - | - | - | 10 | - | 10 |
| 550-574 | - | - | - | - | - | - | 3 | 1 | 4 |
| 575-599 | - | - | - | - | - | - | - | 5 | 5 |
| 600-624 | - | - | - | - | - | - | - | - | - |
| 624-649 | - | - | - | - | - | - | - | 2 | 2 |
| Total | 1 | 1 | 8 | 23 | 55 | 46 | 26 | 8 | 168 |
| Length Range (mm) | 170 | 222 | 228-305 | 310-389 | 375-458 | 402-505 | 481-562 | 571-647 | 170-647 |
| Mean Length(mm) | 170 | 222 | 275 | 356 | 424 | 467 | 524 | 599 | 440 |
| % of Total | 0.6 | 0.6 | 4.8 | 13.7 | 32.8 | 27.4 | 15.3 | 4.8 | 100.0 |

TABLE 27. Comparative Effectiveness of Terminal Gear used by Anglers,
Copper River, May 29 - October 3, 1972.

| <u>Angler Catch and Effort</u> | <u>Terminal Gear</u> | | | <u>Tot.</u> |
|--------------------------------|----------------------|--------------|---------------|-------------|
| | <u>Flies</u> | <u>Lures</u> | <u>Other*</u> | |
| Total angler hours | 1,709.5 | 742.5 | 830.0 | 3,282.0 |
| Total rainbow trout caught | 1,911 | 403 | 731 | 3,045 |
| Rainbow trout catch/hour | 1.11 | 0.54 | 0.88 | 0.92 |
| Total rainbow trout retained | 127 | 157 | 145 | 429 |
| Rainbow trout retained/hour | 0.07 | 0.21 | 0.18 | 0.13 |

* Some anglers used both flies and lures during a single day. As the totals for each tackle type were not easily separable in these cases, these anglers' effort and results were included under "other" and not included in the categories for flies only or lures only.

ECONOMIC EVALUATION

Location (stream) _____ Date _____

Number in Party: Adults _____ Minors _____ Total _____

Resident _____ Non-resident _____ Living in Ak. Yes _____ No _____

Residence (town) _____ Residence (town) _____

Civilian _____ Military _____ Civilian _____ Military _____

ESTIMATED EXPENDITURES (Entire Trip)

| In-State | Out-of-State |
|----------------------------------|---------------------------------|
| Travel | Travel |
| Aircraft | Aircraft |
| Commercial: From _____ To _____ | Commercial: From _____ To _____ |
| AND RETURN _____ \$ _____ | \$ _____ |
| Charter: From _____ To _____ | Private: \$ _____ |
| type _____ Ret _____ \$ _____ | Automobile \$ _____ |
| Lodgings | Lodgings |
| S.F. Facility _____ Days _____ | |
| @ _____ \$ _____ | |
| Other \$ _____ | |
| Food \$ _____ | Food \$ _____ |
| Fishing Equipment | Fishing Equipment |
| This Trip \$ _____ | This Trip \$ _____ |
| Miscellaneous Expenditure | Miscellaneous |
| _____ | _____ |
| _____ | _____ |
| Total _____ | Total _____ |
| Grand Total: \$ _____ | |

Comments: _____

FIGURE 5 Economic Survey Interview Form.

Commercial airlines, air charter services, private aircraft, and private motorized boats were used by the anglers to travel from various points of origin to Copper River. The type of aircraft, pilot and/or owner, and origin of all flights were noted. Air charter services were contacted by Department personnel to obtain information on charter fees and hourly rates. Flight times for each aircraft type were multiplied by appropriate hourly charter fees to determine an average cost per flight from points of origin in Alaska to the river, and return. Commercial airline fares were obtained from the Official Airline Guide (November, 1972).

Anglers visiting Copper River utilized several available lodging options, i.e., tents, lodges, private cabins, and homes. Lodging rates and boat rental rates were obtained directly from the lodge and concession owner.

Charter fees and boat rentals were assumed to have been split equally among party members using the aircraft or boat.

Guides were contacted personally to determine daily and/or per party guide fees. Miscellaneous expenses included food and beverages consumed while camping at the river, taxidermy fees, fishing tackle, special apparel, licenses, and citations. Food and lodging, while in metropolitan areas, were also included in the economic evaluation.

Presentation and expansions of data are as follows:

| | <u>No. Anglers Censused</u> | <u>No. Angler Days Fished</u> | <u>Avg. Angler-Days Fished</u> | <u>Total Expenditures</u> | <u>Cost/ Angler Day</u> |
|------------------|-------------------------------------|---------------------------------------|--|-------------------------------|-----------------------------|
| Resident | 103 | 224 | 2.17 | \$16,370.00 | \$ 73.08 |
| Non- resident | <u>113</u> | <u>425</u> | <u>3.20</u> | <u>\$83,786.50</u> | <u>\$197.14</u> |
| Total | 236 | 649 | 2.75 | \$100,156.50 | \$154.32 |

Average Expenditures/Trip to Copper River

| | |
|-------------|----------|
| Resident | \$158.93 |
| Nonresident | \$629.97 |
| Combined | \$424.39 |

The 236 anglers, surveyed for economic data, fished a total of 649 angler days or 77.9% of the 833 angler days observed at Copper River.

Therefore:

$$\frac{649 \text{ angler days}}{833 \text{ angler days}} = \frac{\$100,156.50}{X}$$

and X=\$128,552.18, the total monies expended during 833 angler days at Copper River during the 127-day period from May 29 through October 3, 1972.

And:

$$\frac{\$128,552.18}{127 \text{ days}} = \$1,138.71 \text{the average}$$

spent each day by the Copper River sport fishermen-user group.

A total of 3,612 rainbow trout were estimated caught during the 127-day period.

$$\text{Cost/rainbow trout} = \frac{\text{Total expenditures}}{\text{No. of rainbow trout caught}}$$

Cost per rainbow trout:

| | <u>No.</u> | <u>Cost</u> |
|----------|------------|-------------|
| Caught | 3,612 | \$ 40.04 |
| Retained | 529 | \$243.01 |

Of the estimated 529 rainbow trout retained, 214 were measured and 109 were weighed by Department personnel. The average length of the rainbow trout retained was 445 mm (17-1/2 inches). The average weight was 1.08 kg (2 pounds, 6 ounces).

The cost/inch of rainbow trout retained was obtained by dividing total expenditures by total inches and equalled \$13.89 per inch (25.4 mm).

The cost/pound of rainbow trout retained (\$102.11/pound - \$226.91 per kg), was obtained by dividing total expenditures by total pounds of rainbow trout.

Breakdown of angler place of residence:

| | | |
|-----------|------------------------|----------|
| Resident: | Anchorage | 90 |
| | Kenai-Soldotna | 4 |
| | Lake Iliamna Area | 1 |
| | Fairbanks | 7 |
| | Other areas of Alaska | <u>1</u> |
| | Total Resident Anglers | 103 |

| | | |
|---------------|------------------------------------|----------|
| Non-resident: | Far West | 75 |
| | Rocky Mountains | 8 |
| | Mid-West | 19 |
| | South | 19 |
| | Northeast | 9 |
| | Foreign Countries | <u>3</u> |
| | Total Non-resident Anglers | 133 |
| | Total Anglers - Copper River, 1972 | 236 |

Angler Expense Categories (not expanded)

| | |
|--|--------------------|
| Commerical air travel, in-state | \$ 4,547.00 |
| Commercial air travel, out-of-state | \$ 32,812.00 |
| Air charter services, in-state | \$ 18,577.00 |
| Private air travel, in-state | \$ 2,664.50 |
| Local lodging and guide services | \$ 32,474.00 |
| Miscellaneous (includes Anchorage meals, lodging, licenses, taxidermy services, fishing and camping equipment, citations, boat rentals, food and drink). | <u>\$ 9,082.00</u> |
| Total expenses incurred by 236 anglers surveyed at Copper River during 1972 | \$100,156.50 |

Nick G. Creek

Rainbow Trout:

Spring Spawning Activities:

Foot surveys were conducted to determine whether rainbow trout spawn in Nick G. Creek, a tributary to Intricate Bay, approximately two miles northeast of Copper River (Figure 4).

Nick G. Creek is a small stream with forks originating in two small lakes. The east fork originates in Flat Lake and has an impassable waterfall approximately 1/2 mile above its confluence with the west fork. The west fork originates in Char Lake and is accessible to fish throughout its 1/2 mile length.

Rainbow trout used both forks of Nick G. Creek for spawning in 1972. The east fork had the majority of the spawners. No rainbow trout were observed during surveys of Nick G. Creek on May 6 and May 23, 1972. Rainbow trout prespawners were observed first in Nick G. Creek on May 18. On May 28, rainbow trout were observed paired in the west fork of Nick G. Creek and on June 10, were observed spawning in the east fork of Nick G. Creek.

The peak of rainbow trout spawning in Nick G. Creek was estimated to have occurred between June 5-15, 1972. The total number of rainbow trout spawning in Nick G. Creek was estimated at between 20-30 fish.

Summer and Fall Sampling Activities:

Nick G. Creek was surveyed on August 22, 1972. Several juvenile rainbow trout were observed. Freshwater crustaceans and salmon eggs were found in the stomachs of two stream-dead juvenile rainbow trout sampled.

On September 15, a variable mesh gillnet was set in Char Lake and three rainbow trout were caught. They ranged in length from 217-433 mm. The gonads examined from the two larger rainbow trout (220 mm and 433 mm) were maturing and these fish would have spawned during the coming spring.

DISCUSSION

The Copper River rainbow trout spawning population consisted of 99.1% age VII to X fish. These were also the dominant age groups represented in the angler bag. The percentage of redeveloping spawners and rainbow trout that would spawn for the first time the following spring was determined from the angler harvest by determining the number of age VI through IX fish retained as opposed to the total number retained. Ages VI through IX rainbow trout constituted 89.2% of the fish appearing in the angler bag. Thus, of the 529 angler-retained rainbow trout, 472 (89.2%) were potential spawners.

The average length of Copper River rainbow trout spawners was 496 mm (approximately 19.5 inches). The 1972 harvest regulation stated that an angler could retain per day or possess one bag limit (five rainbow trout, of which only one may be over 20 inches, 508 mm, in length) in the Trophy Fish area. The regulation theoretically allows five Copper River rainbow trout spawners to be taken per angler day. This situation requires continued careful enumeration of the Copper River spawning population and closer monitoring of the angler bag.

The average length of Lower Talarik Creek rainbow trout spawners, in 1972 was 542 mm or 46 mm (approximately 2 inches) greater in length than the Copper River average fish. The Lower Talarik Creek angler bag contained 26.0% post-spawn rainbow trout.

The Lower Talarik Creek rainbow trout spawners do not demonstrate the same migratory patterns as those spawning in Copper River. Lower Talarik Creek rainbow trout migrate, during a short time period after spawning into Lake Iliamna (some may migrate into Lower Talarik Creek headwater lakes, while a large number of the Copper River rainbow trout tend to remain in the river after spawning. Thus, the Lower Talarik Creek

spawners are not available to the angler throughout the entire summer angling period, as in Copper River. Due to the Lower Talarik Creek spawning population structure and migrational characteristics, these rainbow trout stocks do not require the close monitoring as do the Copper River stocks. The existing Trophy Fish Area bag restriction (mentioned previously) does a satisfactory job in protecting the potential spawners.

Rainbow trout that have been tagged in Copper River and Lower Talarik Creek have been recovered throughout Lake Iliamna. Tag recoveries tend to indicate fish passage along the Lake Iliamna shores since many of the fish recaptured were taken along the lake shore or off the mouths of creeks and rivers. These recoveries indicate that rainbow trout spend part of their life cycle in Lake Iliamna. Further studies in Lake Iliamna and its tributaries may provide information on the extent the lake plays in the life cycle of rainbow trout.

Two economic evaluation studies have been accomplished on rainbow trout streams in the Trophy Fish Area. The Lower Talarik Creek study was conducted during 1971 (Siedelman and Cunningham) and the Copper River study during 1972. Comparable economic data follows:

TABLE 28 Comparative Trophy Fish Area Economic Survey Totals, 1971 and 1972.

| | <u>Lower Talarik Creek</u> (1971) | <u>Copper River</u> (1972) |
|--------------------------|--------------------------------------|-------------------------------|
| No. Anglers Surveyed | 301 | 236 |
| No. Angler Days Observed | 587 | 833 |
| Cost/Fish Caught | \$ 51.64 | \$ 40.04 |
| Total Expenditures | \$125,775.96 | \$128,552.18 |

A total expenditure in excess of \$125,000.00 per year on each stream surveyed is indicated. Expanding these expenditures (average \$127,154.00) to cover all major streams (Lower Talarik Creek, Kvichak, Newhalen, Gibraltar, Copper, and Branch rivers) presently receiving comparable angler pressures in the Trophy Fish Area (Kvichak River Drainage), total estimated expenditures are estimated in excess of \$760,000.00. This Trophy Fish Area's fishery resource provides a substantial economic return to the State of Alaska, even through all expenditures are not retained within the State.

Peak rainbow trout spawning dates for Lower Talarik Creek and Copper River during 1972 were between June 3-7. The Lower Talarik Creek rainbow trout spawning population in 1971 was actively spawning at the end of the June 7 closure date. Thus, the 1971 spawning closure was extended seven days for Lower Talarik Creek, Gibraltar River Drainage, and the Upper Kvichak River to protect the late spawning stocks. In 1972, the spring spawning closure was extended from June 8 through June 17 by emergency order and encompassed the entire Trophy Fish Area. Since these extensions were necessary to protect the rainbow trout spawning stocks, each of the past two years, a regulation extending the spawning closure and closing the entire Trophy Fish Area to sport fishing during this time period should be considered.

Stream bed movement in the vicinity of the weir was a problem throughout the field season. The hydraulic head built behind the weir resulted in excessive erosion under the structure as well as downstream from the structure. No provisions were made in the original weir design for stream bed stabilization, hence installation of perforated metal plank (runway matting) for erosion control during the 1973 field season is planned. The planking will be installed downstream from the structure and in the energy dissipation zone under the weir.

LITERATURE CITED

Official Airline Guide. North American Edition, November 15, No. 21, Reuben Donnelley Corporation, New York, New York, 1972.

Siedelman, D. L. and Cunningham, P.B. 1972. Studies of Unique Trophy Game Fishes. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1971-1972, Project F-9-4, 13 (G-II): 41-66.

Prepared by:

Donald L. Siedelman
Fishery Biologist

Paul B. Cunningham
Fishery Biologist

Richard B. Russell
Fishery Biologist

Approved by:

s/Howard E. Metsker
D-J Coordinator

s/Rupert E. Andrews, Director
Division of Sport Fish